PB92-126960

Nonroad Engine and Vehicle Emission Study-Report

(U.S.) Environmental Protection Agency, Ann Arbor, MI

Nov 91

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1. REPORT NO. EPA 460/3-91-02	2.	3. PB92-126960
4. TITLE AND SUBTITLE Nonraod Engine and Vehicle Emission Study-Report		5. REPORT DATE November 1991
		6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S)		8. PERFORMING ORGANIZATION REPORT NO.
9. PERFORMING ORGANIZATION NAME AND ADDRESS U.S. Environmental Protection Agency Office of Mobile Sources Certification Division Ann Arbor, MI 48105		10. PROGRAM ELEMENT NO.
		11. CONTRACT/GRANT NO.
12. SPONSORING AGENCY NAME AND ADDRESS		13. TYPE OF REPORT AND PERIOD COVERED Final
		14. SPONSORING AGENCY CODE

15. SUPPLEMENTARY NOTES

Draft Report — PB 92-104462. Report includes Appendixes.

16. ABSTRACT

Section 213 of the Clean Air Act (as amended) requires that the Environmental Protection Agency (EPA) complete a study of the contribution of nonroad engines and vehicles to air pollution in areas that fail to meet the National Ambient Air Quality Atandards for ozone and/or carbon monoxide. The act also directs the EPA to study emissions of other pollutants that endanger public health or welfare.

This report is the final study of emissions from nonroad engines and vehicles. Nonroad engines and vehicles include many different types of internal combustion enginesused off the nation's higways. Some examples are: weed wrackers, lawnmowers, airplane tow tractors, all-terrain vehicles, snowmobiles, portable generators, forklifts, bulldozers, asphalt compactors, farm tractors, pleasure boats, and oil tankers.

In this report, EPA also studied emissions nationwide and in the 24 nc nonattainment areas. Emissions of Volatile Organic Compounds (VOC), Oxides of Nitrogen (NOx), Carbon Monoxide (CO), and seven other pollutants were calculated. Emissions from nonroad engines and vehicles were compared to those from other sources such as highway vehicles.

The report appendixes contain detailed background information.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS		b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Agricultural machinery Air Quality Cargo Vehicles Construction Equipment Generators Ground vehicles Marine Engines	Motor vehicles Motor Boats Towing Vehicles Tractors	Clean Air Act Emission Inventories National Ambient Air Quality Standards Ozone Carbon Monoxide Volatile Organic Compounds	

18. DISTRIBUTION STATEMENT Release Unlimited	19. SECURITY CLASS *(This Report)* unclassified	21. NO. OF PAGES 566
	20. SECURITY CLASS *(This page)* unclassified	22. PRICE

EPA Form 2220-1 (9-73)

EPA 460/3-91-02

United States
Environmental Protection
Agency

Office of Air and Radiation
(ANR-443)
Washington, DC 20460

November 1991

PB92-126960

Air

EPA

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REPRODUCED BY
U.S. DEPARTMENT OF COMMERCE
NATIONAL TECHNICAL
INFORMATION SERVICE
SPRINGFIELD, VA 22161

Nonroad Engine and Vehicle Emission Study

Report

November 1991

Certification Division
Office of Mobile Sources
Office of Air & Radiation
U.S. Environmental Protection Agency

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ACKNOWLEDGEMENTS

The Nonroad Engine and Vehicle Emission Study relied extensively on the participation of numerous organizations both within and outside of the U.S. Environmental Protection Agency. A Technical Review Group consisting of industry and state-level government representatives was convened to provide a forum for resolving discrepancies in data used in the analysis. Members of this group are listed in Appendix F. The authors and editors of this report wish to express their sincere appreciation for the efforts of all participants.

The study also relied on analyses developed by EPA contractors. Under the direction of Mr. Charles T. Hare, a review of existing data on the emission characteristics of nonroad engines[*,†] was conducted by the Southwest Research Institute, which also tested the emissions of several lawn and garden engines that had been used in the field.[‡] The EPA Project Officer for this contract was Mr. Craig A. Harvey of the Emission Control Technology Division. The EPA Technical Work Assignment Managers were Mr. Todd L. Sherwood and Mr. Kenneth L. Zerafa, both of the Certification Division. Estimates of local area equipment populations and usage for most nonroad engines and vehicles were developed by Energy and Environmental Analysis, Inc. (EEA) under the direction of Mr. K.G. Duleep.[§] An analysis of commercial marine vessel emissions in six nonattainment areas was developed by Booz • Allen & Hamilton, Inc. (BA&H) under the direction of Ms. Barbara Kuryk.[£] The EPA Project Officers for these two contracts were Ms. Celia Shih (EEA) of the Emission Control Technology Division and Ms. Patricia L. Cox (BA&H) of the Health and Environmental Management Division. The EPA Technical Work Assignment Manager for the EEA and BA&H analyses was Mr. Kevin A.H. Green of the Certification Division.

Many members of the Certification Division in Ann Arbor, MI were instrumental in the completion of this study. Ms. Gay MacGregor, Assistant Director, and Mr. John M. German, Project Manager, provided general and technical oversight, respectively, for the study. Ms. Cheryl F. Adelman provided legal interpretation and guidance in the area of nonroad equipment classification. Ms. Kathy E. Carter managed the production of the draft report and accompanying appendices. Mr. Kevin A.H. Green developed estimates of total emissions from nonroad engines and vehicles for the areas included in the study. Ms. Betsy Lyons McCabe coordinated revisions and additions to the draft and managed the production of the final report and appendices. Ms. Deanne R. North and Ms. Sujan V. Srivastava analyzed state estimates of emissions from nonroad sources. Ms. Clare Ryan coordinated communications inside and outside EPA. With technical guidance from Mr. Michael A. Sabourin, Project Manager, Mr. Jeffrey T. Prince and Mr. Kenneth L. Zerafa developed a data base of evaporative and tailpipe emission factors for nonroad engines and vehicles. Ms. Paula Van Lare reviewed studies of ozone formation and transport and considered their implications for nonroad engines and vehicles. All of the above staff members are especially appreciative of the typing and production assistance provided by Ms. Rae Benedetti and by Ms. Janis S. Hagen, a contractor with the Computer Science Corporation, and of the general assistance from Mr. Donald J. Kachman and Ms. Sherie N. Williams, both student aides in the Certification Division, and also of the assistance with file sharing and printing provided by the Computer Support Section.

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[*] Ingalls, Melvin N. *Nonroad Emission Factors.* Southwest Research Institute, San Antonio, TX, February 1991.

[†] Ingalls, Melvin N. *Nonroad Emission Factors of Air Toxics*, Southwest Research Institute, San Antonio, TX, June 1991.

[‡] Carroll, J.N. *Emission Tests of In-Use Small Utility Engines*, Report 3426-006. Southwest Research Institure, San Antonio, TX, September 1991.

[§] Energy and Environmental Analysis, Inc. *Methodology to Estimate Nonroad Equipment Populations by Nonattainment Areas.* Arlington, VA, September 1991.

[£] Booz • Allen & Hamilton, Inc. *Commercial Marine Vessel Contributions to Emission Inventories.* Los Angeles, CA, October 1991.

Table of Contents

Reading and Using the Study Report and Appendixes iv
Executive Summary v

Chapter 1. Overview and Background 1
1.1. The Air Pollution Problem 1
1.2. Congressional Mandate and Scope of Study 3
1.3. Nonroad Equipment Categories Included in the Study 3
1.4. Pollutants Considered in the Study 4
1.5. Geographic Areas Considered in the Study 6
1.6. Public Participation 7

Chapter 2. Methods and Approach 9
2.1. Structure of Emission Inventories 10
2.2. Developing Equipment and Engine Categories 11
2.3. Development of Emission Factors 13
2.4. Development of Activity Levels for Inventory A 15
2.5. Development of Activity Levels for Inventory B 16
2.6. Comparison of Results from October Draft and Final Study 16
2.7. Comparison of Data Used in Inventories A and B 18
2.8. Emissions from Commercial Marine Vessels 39
2.9. Emissions from Other Sources 41

Chapter 3. Results 45
3.1. VOC, NO_x, CO, and Particulate Nonroad Inventories 45
3.2. VOC, NO_x, CO, and Particulate Nonroad Inventories by Categories 51
3.3. National PM, SO_x, and Air Toxics Inventories 92
3.4. SIP and CARB Inventory Analysis 94

Chapter 4. Discussion and Analysis of Results 96
4.1. Discussion of Inventory Results 96
4.1.1. Volatile Organic Compounds (VOC) Inventories 96
4.1.2. Nitrogen Oxide (NO_x) Inventories 98
4.1.3. Carbon Monoxide (CO) Inventories 99
4.1.4. Particulate (PM) Inventories 100
4.1.5. National Air Toxics Inventories 101
4.2. Analysis of Inventory Methodologies 104
4.2.1. Data Differences 104
4.2.2. Factors Causing Overestimation or Underestimation 106
4.2.3. Additional Considerations 108
4.3. Analysis of Nonroad Emission Impact 112

Chapter 5. Conclusions 115

References 118

List of Tables

Table ES-01. Equipment Categories Included in Study ... vi
Table ES-02. Examples of Emissions from New Nonroad Equipment Relative to a Typical *In-Use* Passenger Car ... vi
Table ES-03. Pollutants Included in the Study ... vii
Table ES-04. Median Contributions of Nonroad Categories to VOC, NO_X and CO Emission Inventories A and B, with New Engine/In-use Estimate Emission Factors ... xii
Table ES-05. Number of Areas in Which Category Contributes at Least 1% of Total Inventory in the 19 Ozone and 16 CO Nonattainment Areas Studied ... xiii
Table 1-01. Equipment Categories Included in Study ... 4
Table 1-02. Pollutants Included in Study ... 5
Table 1-03. Geographic Areas Included in Study ... 7
Table 2-01. Sample CO Emission Inventory ... 10
Table 2-02. Nonroad Mobile Source Equipment Categories ... 12
Table 2-03. Inventory A and B National Population Estimates ... 19
Table 2-04. Inventory A and B Average Rated Horsepower Estimates ... 21
Table 2-05. Inventory A and B Typical Operating Load Factor Estimates ... 23
Table 2-06. Inventory A and B Annual Use Estimates ... 25
Table 2-07. Emission Factors ... 27
Table 2-08a. Summer and Winter Percentages of Yearly Activity. ... 37
Table 2-08b. Summer and Winter Percentages of Yearly Activity for Recreational Marine Equipment ... 37
Table 2-08c. Summer and Winter Percentages of Yearly Activity for Recreational Equipment. ... 38
Table 2-09. Emissions from Commercial Marine Vessels ... 40
Table 2-10. Emissions from Highway Vehicles ... 43
Table 2-11. Emissions from Other Area and Point Sources ... 44
Table 3-01. Total Nonroad Emissions by Nonattainment Area and Pollutant (%) ... 46
Table 3-02. Air Toxics Emission Inventories ... 93
Table 3-03. SIP-Based Inventory Summary ... 94
Table 3-04. CARB-Based Inventory Summary ... 95
Table 4-01. Equipment Categories Contributing at least 1% of Total Summertime VOC ... 97
Table 4-02. Equipment Categories Contributing at least 1% of Total Summertime NO_X Inventory ... 99
Table 4-03. Equipment Categories Contributing at least 1% of Total Wintertime CO Inventory ... 100
Table 4-04. Equipment Categories Contributing at least 1% of Total PM Inventory ... 100
Table 4.05. Summary of Risk Estimates from Motor Vehicle Air Toxics ... 102
Table 4-06. Risk Estimates for Nonroad Toxic Emissions ... 103
Table 4-07. Contribution to Total Inventory ... 113
Table 4-08. Comparison of Ozone Precursor Emissions from Various Vehicles and Equipment ... 114

List of Appendixes

Appendix A. Glossary of Acronyms and Terms A-1
Appendix B. Ozone Formation B-1
Appendix C. Ozone and CO Nonattainment and Air Toxic Risk Estimates C-1
Appendix D. Mobile Source Air Toxics D-1
Appendix E. Manufacturer Association Membership E-1
Appendix F. Technical Review Group Representatives F-1
Appendix G. Emission Inventories Developed Using SIP and CARB Data G-1
Appendix H. List of Equipment Types H-1
Appendix I. Emission Factor Development H-1
Appendix J. Additional Data Submissions J-1
Appendix K. Adjustments to Data in Developing Inventory A K-1
Appendix L. Regional and Seasonal Adjustments to Inventories L-1
Appendix M. Emission Inventory A M-1
Appendix N. EPA Use of Manufacturer Data In Inventory B N-1
Appendix O. Emission Inventory B O-1
Appendix P. Transport and Nonroad Emissions P-1
Appendix Q. Response to Public Comment Q-1

Reading and Using the Study Report and Appendixes

The Nonroad Engine and Vehicle Emission Study has been bound into two volumes - the report and its appendixes. The report contains five chapters which provide information on the purpose and goals of the study, the approach, the results, and a discussion and analysis of those results. Throughout the report, the reader is provided with the basic information needed to understand what was done to obtain the results presented. More detailed information has been put into a series of sixteen appendixes, which are bound separately from the report.

In both the report and the appendixes, the reader will find annotated notes, indicated by a superscript symbol, at the bottom of the page. These notes are provided where it was felt some explanatory information might be needed. Reference citations are indicated by a superscript number. A list of the references cited in the report is located on the last page of the report. In the appendixes, a list of references can be found at the end of each appendix.

Many acronyms are used in the report. While they are defined when first used, a list of acronyms and their meanings is also provided in Appendix A. Appendix A also contains a glossary of some of the terms used in the report.

Executive Summary

Congressional Mandate

This study is a response to the Congressional directive[**] that EPA quantify the contribution of nonroad sources to ozone and carbon monoxide air pollution and to other pollutants believed to endanger public health. The Clean Air Act (CAA), as amended, directs EPA to complete a study of emissions from nonroad engines and vehicles by November 15, 1991. The CAA further requires EPA to regulate emissions from nonroad engines and vehicles within twelve months after completion of the study if the Agency determines that these sources are significant contributors to ozone or carbon monoxide (CO) concentrations in more than one area which has failed to attain the National Ambient Air Quality Standards (NAAQS) for these pollutants. This report does not constitute EPA's determination of significance. Any determination EPA makes relative to the significance of nonroad contributions to air quality will be included as part of any regulations proposed for nonroad engines and vehicles. Opportunities for public comment on any determination of significance will be provided through the regulatory process if the Agency proposes nonroad regulations.

Nonroad Engines and Vehicles

The terms "nonroad engines" and "nonroad vehicles" cover a diverse collection of equipment ranging from small equipment like lawnmowers and chain saws, to recreational equipment, to farm equipment and construction machinery. EPA considered more than 80 different types of equipment in this report. To ease analysis and reporting EPA has grouped equipment into 10 equipment categories listed in Table ES-01.[††]

[**] Section 213(a) of the Clean Air Act, as amended, directs EPA to conduct a study of emissions from nonroad engines and vehicles and to determine if such emissions cause, or significantly contribute to, air pollution which may be reasonably anticipated to endanger public health or welfare.

[††] Locomotives and aircraft are not included in this study because the CAA provides for them separately.

Table ES-01. Equipment Categories Included in Study

Nonroad Equipment Categories	
Lawn and Garden Equipment	Industrial Equipment
Airport Service Equipment	Construction Equipment
Recreational Equipment	Agricultural Equipment
Recreational Marine Equipment	Logging Equipment
Light Commercial Equipment	Commercial Marine Vessels

Nonroad engines are not regulated for emissions, and very few nonroad engines currently use emission control technology. Because of the diversity of nonroad equipment, characterization of the emissions from nonroad engines is a complex task. A comprehensive analysis of the air quality benefits potentially available from reducing nonroad engine emissions has never before been undertaken.

Congress asked EPA to focus on quantifying emissions from unregulated nonroad sources after 20 years of highway mobile sources regulation and increasingly costly controls on the automotive industry. As a group, nonroad engines represent the last uncontrolled mobile source. Potential emission reductions from this source may help resolve local air quality problems. A comparison between pollution emitted by individual pieces of new nonroad equipment and pollution emitted by today's typical in-use passenger car illustrates the logic behind the Congressional mandate.

Table ES-02. Examples of Emissions from New Nonroad Equipment Relative to a Typical *In-Use* Passenger Car

1 Hour of Use	Pollutant	Car Miles
1 lawnmower	VOC	50
1 chain saw	VOC	200
1 outboard motor	VOC	800
1 crawler tractor	NO_x	900

State and Industry Participation

EPA's ability to complete this study has been greatly enhanced by contributions of the nonroad equipment industry and by many state air quality planners. A public workshop was held April 3-4, 1991, and individual meetings were held with many nonroad manufacturing groups. An informal group of technical experts, including industry and state representatives, provided valuable data and technical feedback throughout this study process. In many cases the nonroad manufacturers invested resources to provide detailed information to help construct nonroad emission inventories. On October 30, 1991, EPA held a public meeting on the full draft of this report.

Study Approach

To estimate the contribution of nonroad sources to air pollution, EPA constructed national emission inventories of nonroad sources, as well as local inventories for 19 ozone and 16 carbon monoxide (CO) nonattainment areas. Since it was not possible to construct inventories for all nonattainment areas within the time allowed for this study, these areas were selected to represent a spectrum of demographic and geographic characteristics. They also represent most of the nation's most severe air pollution problems.

Because Congress specified that EPA study the nonroad source contribution to ozone and CO nonattainment, the study primarily focuses on CO and on the pollutants that contribute to ozone formation, volatile organic compounds (VOC) and oxides of nitrogen (NO_x). However, the study addresses all the pollutants listed in Table ES-03.

Table ES-03. Pollutants Included in the Study

Pollutants	
Volatile Organic Compounds (VOCs)	Benzene
Oxides of Nitrogen (NO_x)	Aldehydes
Carbon Monoxide (CO)	1,3-butadiene
Particulate Matter (PM)	Gasoline Vapors
Sulfur Dioxide (SO_2)	Nitrosamines

Constructing Emission Inventories

Emission inventories are detailed listings of the amount of pollution generated by different sources in a given area over a specific period of time. In constructing nonroad inventories, several factors must be estimated: (1) equipment populations in a given nonattainment area, (2) annual hours of use of each type of equipment adjusted for geographic region and for the season of interest for each pollutant studied, (3) average rated horsepower of each type of equipment, (4) typical load factor for each type of equipment, and (5) an emission factor (EF), or average emissions of each pollutant per unit of use (e.g., g/hp-hr) for each category of equipment.

Given the number of engine types and equipment included in the study and the limited amount of data available characterizing emissions from nonroad sources, EPA chose to construct two sets of inventories. In the first set, EPA constructed inventories that incorporate commercially and publicly available data so that the method could be repeated by interested states. The second set of inventories incorporated industry-provided data that might not be publicly available to states (e.g., confidential sales data to estimate populations), but would give EPA a valuable cross check for the first set of inventories. This report presents both sets of inventories:

> **Inventory A** which relies heavily on a commercially available marketing research data base[‡‡] and publicly available indices of commercial activity to estimate equipment populations;
>
> and
>
> **Inventory B** which incorporates manufacturer-provided data in almost all high usage categories.

Both inventories use the same emission factors for all pollutants except particulates. EPA and its contractors, with the assistance of industry, updated nonroad emission factors for this study using all available test data, including evaporative and refueling (spillage) emission data. Most of the emission data for nonroad engines are based on tests of new engines. The limited information EPA does have on in-use nonroad engines shows that in-use emissions could be as much as two times higher for some types of equipment than emission estimates using emission factors based on new engine test data. Consequently, inventories calculated using new engine emission factors (new engine EFs) will underestimate the contribution of nonroad engines to air pollution. EPA has developed a second set of emission factors (in-use EFs) for VOC and CO that includes a gross adjustment for in-use deterioration. Because of the uncertainty involved in making in-use adjustments, the report presents estimates for both Inventories A and B with and without the adjustment. In-use adjustments assume very little deterioration by diesel engines. Hence, category-specific inventories (e.g., Construction Equipment) for categories dominated by diesel engines show very little difference between the inventories estimated using new engine EFs and in-use EFs. The estimates using the new engine EFs should be considered the conservative lower bound of nonroad contribution in each nonattainment area.

[‡‡] Power Systems Research maintains a marketing research data base that includes most types of nonroad equipment.

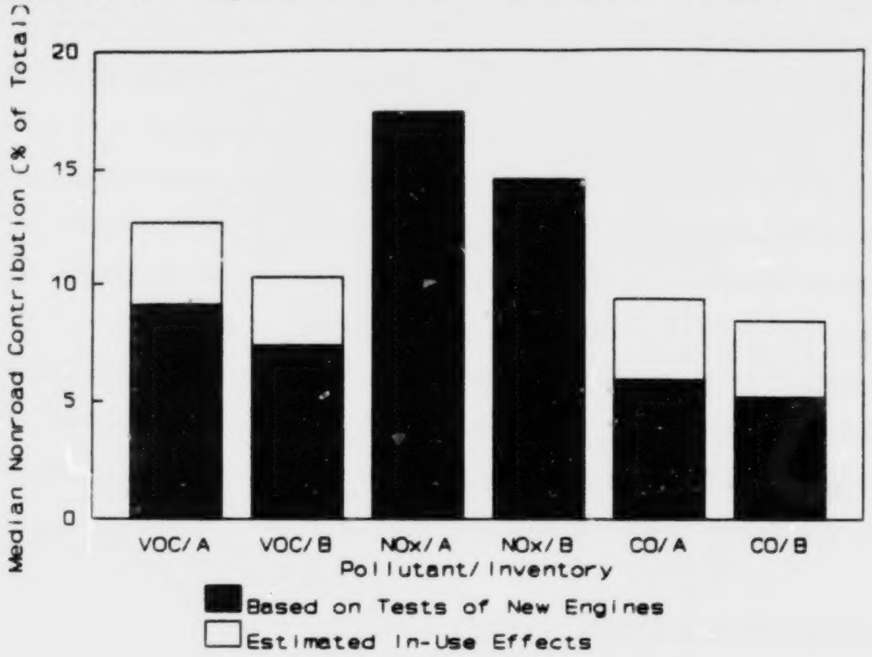
Highlights of Study Results

Results are presented for all nonroad sources and for each equipment category.

Aggregate Nonroad Contributions to Inventories

The results of Inventories A and B are similar. Chart ES-01 shows the median contributions to total inventories in the 19 ozone and 16 CO nonattainment areas studied. In general, Inventory B estimates lower emissions than Inventory A.

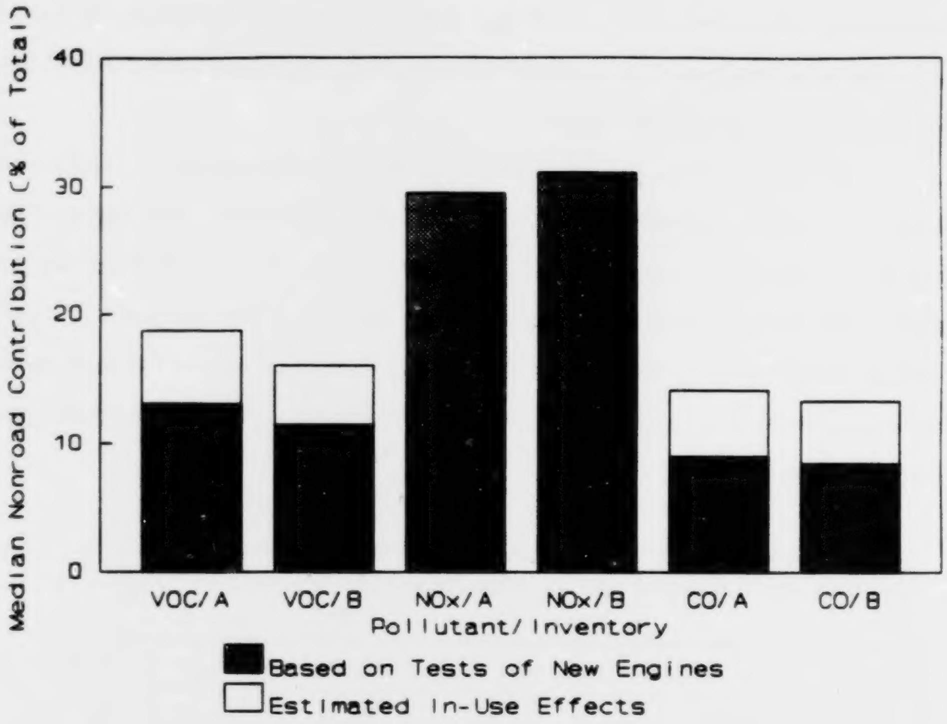
Chart ES-01. Comparison of Median Contributions - Inventory A & B



Under the most conservative assumptions, using the new engine EFs and choosing the lowest estimate from Inventories A and B combined, minimum contributions by pollutant for all cities studied were as follows: 2.9% VOC, 7.6% NO_x, and 2.2% CO. It is often useful to look at the second highest and second lowest values in the range to avoid any "outliers" that might skew the data. For example, the second lowest contribution of VOC in any nonattainment area studied was 4.5%, for NO_x 9.7%, and for CO 2.3%.

It is also useful to look at the nonattainment area with the second highest contribution since Congress requires EPA to regulate nonroad engines if it finds that nonroad engines are significant contributors to pollution in more than one nonattainment area. Chart ES-02 shows, for VOC, NO_x, and CO, the level of contribution in the nonattainment area with the second highest contribution from nonroad sources.

Chart ES-02. Percent Contribution from Nonroad Sources in the Nonattainment Area with the Second Highest Contribution Level



Nonroad Contribution to Inventories by Equipment Category

The individual nonroad categories contributing most heavily to the inventories vary by pollutant. Both Inventory A and B show substantial summertime VOC emissions from nonroad sources. These emissions are primarily from lawn and garden equipment and from the recreational marine category. About 7.5% of the lawn and garden contribution to nonroad VOC inventories is due to evaporative emissions from spilling fuel when refueling equipment.

The nonroad portion of total summertime NO_x emissions is estimated to be about the same, on a percentage basis, as the portion of total VOC emissions from nonroad sources. By far the largest contributor to nonroad NO_x emissions is construction equipment. Inventory A shows in all areas studied that construction equipment contributions exceed 6% of the total NO_x inventory. Inventory B shows that in 15 of the 19 areas, NO_x emissions from construction equipment exceed 5% of the total inventory. Agricultural, industrial, airport service, and commercial marine engines are also important contributors of NO_x in some areas.

Unlike VOC and NO_x emissions, no one category dominates the nonroad CO emission contribution. Light commercial, lawn and garden equipment, industrial, commercial marine, and recreational equipment categories each contribute a minimum 1.4-2.2% of total wintertime CO in at least two areas.

Table ES-04 shows the contributions of the different nonroad engine and vehicle categories to total inventories of VOC, CO, and NO_x emissions. The contributions are expressed in percent of total emissions from *all* sources. The values given are medians of the contributions in the various nonattainment areas studied. These are given for both inventories A and B, using emission factors first based on new engines and second incorporating EPA's estimate of in-use effects. Finally, the median contribution from all nonroad engines and vehicles is shown.

Table ES-04. Median Contributions of Nonroad Categories to VOC, NO_x and CO Emission Inventories A and B, with New Engine/In-use Estimate Emission Factors

	% Total VOC tpsd		% Total NO_x tpsd		% Total CO tpwd	
Source Category	**Inv. A**	**Inv. B**	**Inv. A**	**Inv. B**	**Inv. A**	**Inv. B**
Lawn and Garden	2.6-4.7	2.4-4.1	0.2	0.2	0.6-1.1	0.5-0.9
Airport Service	0.1-0.1	0.1-0.1	1.1	1.2	0.2-0.2	0.2-0.2
Recreational	0.2-0.4	0.2-0.3	0.0	0.0	0.4-0.8	0.4-0.7
Light Commercial	0.6-1.0	0.6-1.1	0.2	0.2	2.0-3.6	2.0-3.7
Industrial	0.4-0.5	0.4-0.4	1.7	1.3	1.3-1.5	1.1-1.4
Construction	1.0-1.1	0.8-0.8	9.7	8.4	0.5-0.6	0.4-0.5
Agricultural	0.2-0.2	0.2-0.2	1.6	1.7	0.1-0.1	0.1-0.1
Logging	0.0-0.0	0.0-0.0	0.0	0.01	0.0-0.0	0.0-0.0
Recreational Marine	3.4-4.0	2.2-2.5	0.3	0.2	0.1-0.1	0.1-0.1
Commercial Marine	0.1-0.1	0.1-0.1	0.7	1.0	0.1-0.1	0.1-0.1
Total Nonroad	9.1-12.6	7.4-10.3	17.3	14.5	5.9-9.4	5.2-8.5

Relative Contributions of Nonroad and Other Emission Sources

One of the difficulties in improving air quality is that a multitude of small sources contribute to air pollution. In fact, many of what are considered "large" sources are actually groups of smaller sources (e.g., motor vehicles are categorized into light-duty vehicles, light-duty trucks, heavy-duty vehicles). Most large sources, like motor vehicles, have substantially reduced emissions because of regulatory requirements over the past two decades. Because many of the technologically and economically feasible reductions available from large sources have already been realized, a number of emission control programs recently mandated by Congress are aimed at achieving marginal inventory reductions. These reductions are relatively small compared to past reductions taken from an uncontrolled baseline. Since marginal reductions tend to be costly, the EPA has begun to focus on controlling many small sources of pollution. Because nonroad engines are uncontrolled, it is reasonable to expect that introduction of controls on sources emitting 1% of the total inventory would at least achieve benefits in the range of many other control programs now mandated by Congress in the CAA.

Table ES-05 shows, using the new engine EFs, the number of nonattainment areas in Inventories A and B in which specific nonroad categories contribute at least 1% of total inventory. Many of these areas exceed the 1% contribution by a wide margin.

Table ES-05. Number of Areas in Which Category Contributes at Least 1% of Total Inventory in the 19 Ozone and 16 CO Nonattainment Areas Studied

Nonroad Category	Number of Areas > 1% Inventory A/B		
	VOC	NO_x	CO
Lawn and Garden	19-18	0-0	5-3
Recreational Marine	17-17	2-1	0
Commercial Marine	1-1	10-9	2-2
Recreational Equipment	2-0	0	3-2
Light Commercial Equipment	2-2	0	15-15
Construction Equipment	11-5	19-19	3-0
Agricultural Equipment	1-1	12-13	0
Airport Service Equipment	0	12-12	0
Industrial Equipment	0	13-13	12-10

Charts ES-03 through ES-08 show VOC, NO_x, and CO emission inventories for nonattainment areas typical of those included in the study.[11] For comparison, the national emission inventories are also shown.

The nonroad portion of each chart is based on the average between Inventories A and B with and without adjustments for increased in-use emissions. The key at the bottom of each page lists the other sources included in the charts.

The nonroad contribution to the summertime VOC inventory for the New York CMSA/NECMA is greater than the combined contribution from all highway vehicles except light-duty gasoline vehicles. For the Philadelphia CMSA, the nonroad summertime NO_x contribution is larger than that from all heavy-duty highway vehicles. The nonroad contribution to the wintertime CO inventory for the Denver CMSA is greater than the combined contribution from all other sources except highway vehicles.

Nationally, the nonroad summertime VOC and NO_x contributions are greater than those from any other single source categories except solvent evaporation (VOC) and electrical generation (NO_x). The national nonroad CO contribution is greater than the combined contributions from all highway mobile sources except light-duty vehicles.

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[11] For each pollutant, the area shown is that for which the nonroad portion of the inventory was nearest to the median value for the different areas included in the study.

Chart ES-03. National Summertime VOC Inventory

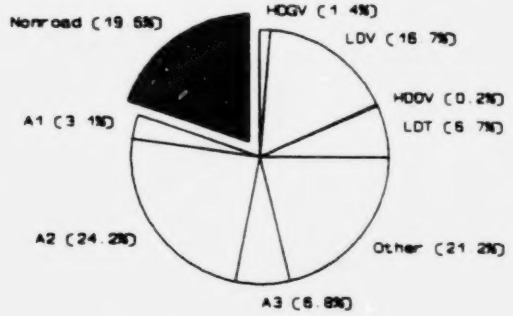
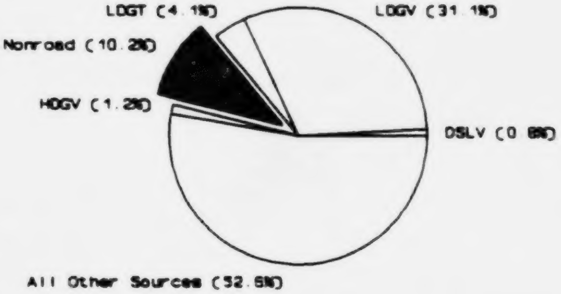


Chart ES-04. New York CMSA/NECMA Summertime VOC Inventory



Highway Mobile Sources

LDGV - light-duty gasoline vehicles
LDV - light-duty vehicles
LDGT - light-duty gasoline trucks
LDT - light-duty trucks
HDGV - heavy-duty gasoline vehicles
HDDV - heavy-duty diesel vehicles
DSLV - diesel vehicles

Area and Point Sources

A1 - petroleum refining
A2 - solvent evaporation
A3 - petroleum product storage/transfer
A4 - electrical generation
A5 - industrial combustion
A6 - industrial processes
A7 - residential fuel use

Chart ES-05. National Summertime NO$_X$ Inventory

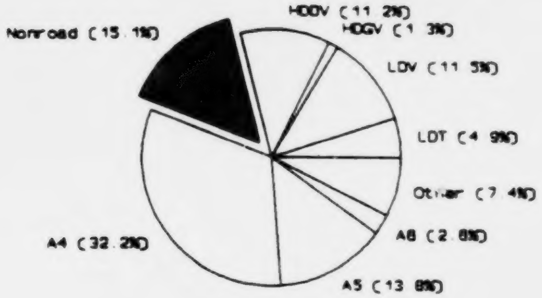
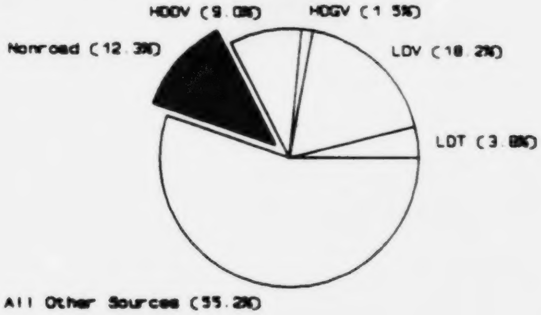


Chart ES-06. Philadelphia CMSA Summertime NO$_X$ Inventory



Highway Mobile Sources

LDGV - light-duty gasoline vehicles
LDV - light-duty vehicles
LDGT - light-duty gasoline trucks
LDT - light-duty trucks
HDGV - heavy-duty gasoline vehicles
HDDV - heavy-duty diesel vehicles
DSLV - diesel vehicles

Area and Point Sources

A1 - petroleum refining
A2 - solvent evaporation
A3 - petroleum product storage/transfer
A4 - electrical generation
A5 - industrial combustion
A6 - industrial processes
A7 - residential fuel use

Chart ES-07. National Wintertime CO Inventory[ff]

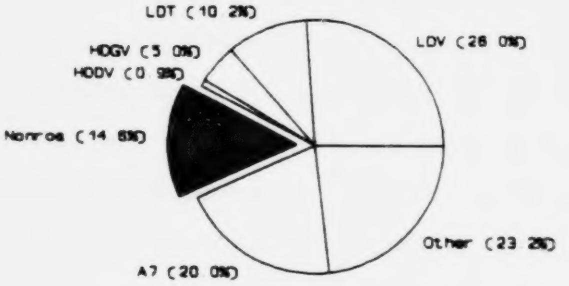
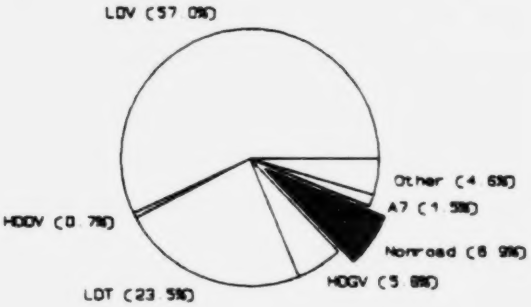


Chart ES-08. Denver CMSA Wintertime CO Inventory



Highway Mobile Sources

LDGV - light-duty gasoline vehicles
LDV - light-duty vehicles
LDGT - light-duty gasoline trucks
LDT - light-duty trucks
HDGV - heavy-duty gasoline vehicles
HDDV - heavy-duty diesel vehicles
DSLV - diesel vehicles

Area and Point Sources

A1 - petroleum refining
A2 - solvent evaporation
A3 - petroleum product storage/transfer
A4 - electrical generation
A5 - industrial combustion
A6 - industrial processes
A7 - residential fuel use

[ff] Corrections for wintertime increases in CO emission factors were not made for either nonroad sources or highway vehicles due to limitations in national-level data.

Because nonroad sources are among the few remaining uncontrolled sources of pollution, their emissions appear large in comparison to the emissions from sources that are already subject to substantial emission control requirements. For example, the CAA requires extreme ozone nonattainment areas to employ Reasonably Available Control Technology (RACT) on all stationary sources with VOC or NO_x emissions above 10 tons per year (tpy). Annual operation of only 10 crawler tractors or 24 agricultural tractors will produce 10 tpy of NO_x. Typical annual operation of only 74-142 boats with outboard motors or 730-1,630 chain saws will emit 10 tpy of VOC.[***] In contrast, it takes 700 new, current-technology passenger cars driving an average of 13,000 miles each in a year (a total of more than 9 million miles) to produce 10 tpy of VOC.

Areas of Further Study

In the process of constructing the study, EPA identified a number of areas where estimates were developed using limited data or were not developed at all because of lack of data altogether. While existing nonroad emission factors estimate tailpipe emissions from relatively new engines, more work needs to be done to quantify the effects of in-use deterioration, crankcase and evaporative emissions, toxic and particulate emissions, and emissions under cold start conditions. Because these emissions are not totally captured by the emission factors used in this study, the inventories presented in the study, particularly those calculated using the new engine emission factors, are likely to be conservative estimates of the nonroad contribution to air pollution.

[***] These numbers indicate the range between data used to develop A and B national inventories.

Chapter 1. Overview and Background

The cornerstone of the Clean Air Act (CAA) is the effort to attain and maintain National Ambient Air Quality Standards (NAAQS).[1] [†††] Prior to the enactment of the 1990 CAA Amendments (CAAA), efforts to achieve and maintain air quality standards focused on regulation of emissions from on-highway, area, and stationary sources. As a result of these efforts, significant progress has been made in reducing such emissions. However, due to the growth in air pollution sources, many air quality regions have failed to attain the NAAQS, particularly those for ozone and carbon monoxide (CO).

The CAAA contain numerous provisions that are intended to remedy these continuing air quality problems, through the application of new controls on currently regulated mobile and stationary sources of emissions and the promulgation of regulations for new sources. As part of the effort to identify and control unregulated sources of air pollution, the CAAA direct the U.S. Environmental Protection Agency (EPA) to study contributions to air quality from nonroad engines[‡‡‡] and nonroad vehicles[§§§] (other than locomotives or engines used in locomotives).[£££] This study is the result of that directive.

1.1. The Air Pollution Problem

The CAA requires the EPA to set air quality standards for common and widespread pollutants after preparing "criteria documents" summarizing scientific knowledge on their health effects. Currently, six "criteria" pollutants are regulated by primary and secondary

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[†††] Reference citations are indicated by a superscripted number. A list of citations can be found at the end of the report.

[‡‡‡] Section 216(10) of the CAA, as amended, defines "nonroad engine" as an internal combustion engine (including the fuel system) that is not used in a motor vehicle or a vehicle used solely for competition, or that is not subject to standards promulgated under section 111 (new stationary sources) or section 202 (motor vehicles) of the CAA. As defined in section 216(2) of the CAA, "motor vehicle" means any self-propelled vehicle designed for transporting persons or property on a street or highway.

[§§§] Section 216(11) of the CAA, as amended, defines "nonroad vehicle" as a vehicle that is powered by a nonroad engine and that is not a motor vehicle or a vehicle used solely for competition.

[£££] Emissions from locomotives and new engines used in locomotives are being addressed in a separate study, as required under section 213(a)(5) of the CAA, as amended.

NAAQS.[****] As of 1989, over one-half of the population of the United States was still exposed to levels of these pollutants which were considered unhealthful by EPA.

Based on air quality data from 1988-1989, more than 33 million people resided in the 41 areas that failed to meet the NAAQQS for CO.[2] An area is considered to have failed to attain the NAAQS for CO if it exceeds 9 parts per million (ppm) two or more times in a two year period. Carbon monoxide, formed as a result of the incomplete combustion of fuel, is emitted during the combustion process.

In contrast to CO, ozone is formed in the atmosphere as a result of a complex series of chemical reactions between oxides of nitrogen (NO_X) and volatile organic compounds (VOCs). In most urban nonattainment areas, both NO_X and VOCs must be substantially reduced to bring the area into attainment of the ozone standard. Further, since airborne ozone and NO_X, and possibly VOCs, can be transported from one area to another, attainment of the ozone standard in some areas may require control of NO_X and VOC emissions in upwind regions.

An area is in nonattainment for ozone if it exceeds 0.12 ppm more than three times in a three year period. In 1987-1989, 96 U.S. cities exceeded the standard for ozone. Of these cities, nine were classified as "severely" polluted, experiencing peak ozone levels that exceeded the standard by 50 percent or more. Based on 1989 air quality data, over 66 million people lived in counties not meeting the ozone standard.[3] Appendix B contains a description of ozone formation and a bibliography of the literature on ozone. A list of carbon monoxide and ozone nonattainment areas can be found in Appendix C.

As with CO and ozone, many areas are in nonattainment for particulate matter (PM). At the time the CAAA were enacted, 73 areas failed to meet the NAAQS for PM. Over 28 million people lived in areas not meeting the particulate standard in 1989.[4] [††††]

In addition to problems associated with nonattainment of the NAAQS, EPA is concerned with the health risks associated with air toxics. Most air toxics are hydrocarbon compounds capable of causing adverse health effects. Benzene, formaldehyde, and 1,3-

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[****] NAAQS have been established for particulate matter (PM), sulfur dioxide (SO_2), carbon monoxide (CO), nitrogen dioxide (NO_2), ozone, and lead.

[††††] The estimate for particulate matter is considered a lower bound estimate, because the PM_{10} monitoring network is still evolving.

butadiene are emitted by motor vehicles and are considered to be human or probable human carcinogens. Some air toxics, such as benzene, are components of gasoline and can be emitted as unburned fuel or as fuel that evaporates. Other air toxics, such as formaldehyde, which results from the same reactions that form ozone, and 1,3-butadiene, are not present in fuel, but are by-products of incomplete combustion. A summary of cancer risk estimates associated with motor vehicle pollutants of most concern can be found in Appendix C.

1.2. Congressional Mandate and Scope of Study

Section 213(a) of the CAA, as amended, directs EPA to conduct a study of emissions from nonroad engines and vehicles and to determine if such emissions cause, or significantly contribute to, air pollution which may reasonably be anticipated to endanger public health or welfare. Within 12 months after the completion of the study, the Administrator of EPA must determine whether the emissions of CO, NO_X, and VOCs from such new or existing engines or vehicles are significant contributors to ozone or CO concentrations in more than one area which has failed to attain the NAAQS for ozone or CO. If an affirmative determination is made, the Administrator is required to promulgate regulations containing standards applicable to emissions from those classes or categories of new nonroad engines and vehicles which in the Administrator's judgment cause, or contribute to, such air pollution.

This study is the result of the directive in section 213(a) that EPA conduct a study of nonroad emissions. The study quantifies, through the use of nonroad equipment emission inventories, the contributions of nonroad sources to air quality problems. The study does not make a determination of the significance of emissions from nonroad sources. Such a determination will be included as part of any regulations promulgated for nonroad engines and vehicles.

1.3. Nonroad Equipment Categories Included in the Study

EPA considered over 80 different types of equipment in this analysis. To ease analysis and reporting and to assist the disaggregation of national or state equipment populations to the local level, EPA grouped the equipment types into the 10 equipment categories listed in Table 1-01. Additional information on these equipment types and equipment categories can be found in Chapter 2. It should be noted that these categories were developed only for use in this study and are not intended to represent potential regulatory categories. Aircraft and locomotives were not included in this study.[‡‡‡‡]

Table 1-01. Equipment Categories Included in Study

Categories
Lawn and Garden Equipment
Airport Service Equipment
Recreational Equipment
Recreational Marine Equipment
Light Commercial Equipment
Industrial Equipment
Construction Equipment
Agricultural Equipment
Logging Equipment
Commercial Marine Vessels

1.4. Pollutants Considered in the Study

Although numerous pollutants have the potential to meet the criteria set forth in the CAAA for inclusion in the study, EPA chose to limit the number of pollutants examined in this study to those listed in Table 1-02.

[‡‡‡‡] Aircraft are already regulated under a separate subpart of the Clean Air Act and, hence, are not classified as nonroad engines or vehicles. Locomotives were specifically excluded from inclusion by Congress in the CAAA.

Table 1-02. Pollutants Included in Study

Pollutants
Volatile Organic Compounds (VOCs)
Oxides of Nitrogen (NO_X)
Carbon Monoxide (CO)
Particulate Matter (PM)
Sulfur Dioxide (SO_2)
Benzene
Aldehydes
1,3-butadiene
Gasoline Vapors
Nitrosamines

Section 213(a) of the CAA, as amended, requires that VOCs, CO, and NO_X be included in the nonroad study. Of the three other NAAQS criteria pollutants (PM, SO_2 and lead), EPA chose to include PM and SO_2, since both are currently regulated for on-highway sources and have been identified as contributing to air quality conditions that are dangerous to public health or welfare. The last criteria pollutant, lead, although highly toxic, was not included in the study because the CAAA prohibit the production of motor vehicle engines and nonroad engines that require leaded gasoline after model year 1992.

Nonroad sources also emit other pollutants commonly referred to as air toxics, which include carcinogens, mutagens, and reproductive toxins. Currently, little information exists regarding air toxic emissions from nonroad engines and vehicles or the health effects of such emissions. Moreover, none of these pollutants from on-highway sources have been regulated on the basis of carcinogenicity.

EPA's authority to include air toxics in this study is derived from section 213(a)(4) of the CAA. In determining which air toxics to examine, EPA considered three sources of information: compounds suggested by contractors which show the greatest cancer incidences and other risks,[5] pollutants to be included in EPA's CAA-mandated study of mobile source-related air toxics, and those pollutants emitted from nonroad sources which are found in Title III of the CAA. After reviewing the availability of data and the cancer risk incidences, EPA chose to address the following air toxics in this study: benzene; aldehydes; 1,3-butadiene; gasoline vapors; and nitrosamines. Appendix D contains a listing of the air toxics considered in this study.

1.5. Geographic Areas Considered in the Study

In determining which geographic areas to include in the study, EPA decided to focus on the 24 areas, listed in Table 1-03, which failed to attain the NAAQS for either ozone, CO, or both. Nineteen of the areas were evaluated for VOCs and NO_X, and 16 areas for CO. A primary reason for selecting these areas is the severity of their local air quality problems. EPA also believes these areas are representative of other urban areas with air pollution problems due to their diverse geographic and demographic characteristics.

Table 1-03. Geographic Areas Included in Study

Nonattainment Areas	
Atlanta, GA MSA	Minneapolis-St. Paul, MN-WI MSA
Baltimore, MD MSA	New York-Northern NJ-Long Island, NY-NJ-CT CMSA/NECMA[‡‡‡‡]
Baton Rouge, LA MSA	Philadelphia-Wilmington-Trenton, PA-NJ-DE-MD CMSA
Boston-Lawrence-Salem-Lowell-Brockton, MA NECMA	Provo-Orem, UT MSA
Chicago-Gary-Lake County IL-IN-WI CMSA	St. Louis, MO-IL MSA
Cleveland-Akron-Lorain, OH CMSA	San Diego, CA Air Basin[§§§§]
Denver-Boulder, CO CMSA	San Joaquin, CA Air Basin
El Paso, TX MSA	Seattle-Tacoma, WA CMSA
Hartford-New Britain-Middletown-Bristol, CT NECMA	South Coast, CA Air Basin
Houston-Galveston-Brazoria, TX CMSA	Spokane, WA MSA
Miami-Fort Lauderdale, FL CMSA	Springfield, MA NECMA
Milwaukee-Racine, WI CMSA	Washington, DC-MD-VA MSA

[‡‡‡‡] Consolidated Metropolitan Statistical Area (CMSA) and North East County Metropolitan Statistical Area (NECMA) definitions are given in State and County Metropolitan Area Data Book, U.S. Bureau of the Census, 1986.

[§§§§] California air basins are defined for the purposes of this study as in the 1990 version of the 1987 emission inventory prepared by the California Air Resources Board (CARB) for the State of California.

1.6. Public Participation

EPA recognizes that involvement by the manufacturing and environmental communities is essential in ensuring the effective implementation and enforcement of any policies and regulations which may be developed. Therefore, throughout the nonroad engine and vehicle study process, EPA actively solicited information and comment from interested parties. The information supplied by these parties enabled EPA to use the best available data in developing estimates of the contribution of nonroad engines to air quality problems.

A public workshop was held on April 3-4, 1991, with over 200 persons in attendance. The purpose of the workshop was to discuss the nonroad engine and vehicle study and the Agency's regulatory process. Presentations were made by EPA, state agency representatives, and industry representatives.[*****] EPA requested that manufacturers submit population inventory and emission data for the nonroad equipment to be considered in the study. In addition, a briefing for environmental groups on general air quality issues held in Washington, D.C., on May 14, 1991, included a presentation on the nonroad study.

Following the public workshop, EPA held individual meetings with a number of manufacturers and manufacturer groups, including: Outdoor Power and Equipment Institute (OPEI), Industrial Truck Association (ITA), Engine Manufacturers Association (EMA), the Equipment Manufacturers Institute (EMI), Portable Power Equipment Manufacturers Association (PPEMA), John Deere Company, National Marine Manufacturers Association (NMMA), Manufacturers of Emission Controls Association (MECA), Ford Motor Company, Ford/New Holland, and Tecumseh Products Company. At these meetings, manufacturers provided EPA with up-to-date information which assisted EPA in the development of the inventories in the study. Association descriptions and membership lists are in Appendix E.

An informal external technical review group, composed of representatives from a variety of manufacturer associations and state agencies, was convened by EPA to provide technical review and feedback throughout the development of the study. The review group provided informal feedback on the nonroad population inventory methodology, emission factors, and per-source usage rates for the study. A complete list of the Technical Review Group members is included in Appendix F.

[*****] Presentation materials and other comments are available for public review in Docket #A-91-24.

EPA published a draft of this report for public review in October 1991, and held a public meeting on the nonroad study on October 30, 1991. This report reflects EPA's consideration of comments received on the draft report. A discussion of EPA's response to public comments is found in Appendix Q.

Chapter 2. Methods and Approach

The goal of the EPA Nonroad Engine and Vehicle Emission Study was to develop an inventory of nonroad engine and vehicle emissions within the Congressionally mandated time period. To achieve this goal, EPA used the limited data that was available. Where feasible, these data were updated or new data were developed.

In developing emission inventories for nonroad engines, EPA found that comparisons between existing data were not always direct or easy. One of the biggest challenges was to find a way to present, compare, and analyze data from a variety of sources. Given the number of types of engines and equipment included in the study, and the amount of data available that characterized emissions from nonroad sources, EPA chose to construct two sets of inventories, both of which are presented in this report.

In the first set of inventories (Inventory A), EPA incorporated commercially and publicly available data so that the method of inventory construction could be repeated by interested states. The second set of inventories (Inventory B) incorporated industry-provided data that might not be publicly available to states (e.g., confidential sales data to estimate populations) but which provided EPA with a means of validating the first set of inventories. A discussion of the methodology and data used for both inventories is presented later in this chapter. Each inventory is based, at least in part, on specific data sources:

- Inventory A relies primarily on data provided by contractor studies; in particular, on population and per-source usage rate data derived from recent work contracted by EPA for this study. For most categories of equipment, populations are drawn from a commercially available market research data base. Inventory A also includes some data supplied by states and manufacturers.

- Inventory B incorporates population and per-source usage rate data supplied to EPA by manufacturers and manufacturer associations. For most categories, population estimates were supplied by the manufacturers or are derived from confidential sales data provided by manufacturers. Where gaps existed, data from Inventory A were used, so that a complete inventory could be developed.

The study also considers a third set of inventories, Inventory C, which is based on data developed by individual states for their 1987 State Implementation Plans (SIPs).[†††††] At the time the study was initiated, SIPs provided the most comprehensive source of nonroad engine and vehicle emission data. Each SIP contains a state-developed inventory which considered population and per-source usage rate estimates. However, two factors restricted the ability of EPA to utilize this inventory as a basis of comparison with Inventories A and B. First, the SIPs considered a limited number of nonroad equipment types. Second, a substantial amount of new data on nonroad sources was developed after the states constructed their 1987 draft inventories. Nevertheless, the SIPs still constitute a valuable point of reference. Further discussion of this inventory is found in Appendix G.

2.1. Structure of Emission Inventories

Emission inventories are detailed listings of the amount of pollution generated by different sources in an area during a specific period of time and are used to account for the various sources of different air pollutants. For example, a CO emission inventory might appear as shown in Table 2-01.

Table 2-01. Sample CO Emission Inventory.

Source	1987 tpy*
Light-Duty Highway Vehicles	400
Other Highway Vehicles	200
Nonroad Mobile Sources	300
Other Area and Point Sources	100
Total (All Sources)	1000

* tons per year

[†††††] Title I of the CAA requires states to develop plans to demonstrate how they intend to meet the NAAQS.

In developing emission inventories for nonroad engines and vehicles, EPA used the following formula to calculate emissions from most nonroad sources[‡‡‡‡‡]:

$$M_i = N \times HRS \times HP \times LF \times EF_i$$

where:

M_i = mass of emissions of i^{th} pollutant during inventory period
N = source population (units)
HRS = annual hours of use
HP = average rated horsepower
LF = typical load factor
EF_i = average emissions of i^{th} pollutant per unit of use (e.g., grams per horsepower-hour)

For this study, the product of the annual hours of use, the average rated horsepower, and the load factor is referred to as the *per-source usage rate*. The product of the population and the per-source usage rate is referred to as the *activity level*. Nonroad engine emissions are expressed as tons per year (tpy), except when emissions are adjusted for seasonal usage patterns to reflect tons per summer day (tpsd) or tons per winter day (tpwd).

2.2. Developing Equipment and Engine Categories

The development of an emission inventory requires the estimation of activity levels, which is facilitated by the use of categories that group together types of *equipment*, such as tractors, balers, harvesters, and other types of agricultural equipment, which have common function and use characteristics. Emission factors, on the other hand, are generally best developed for different types of *engines*, such as diesel, gasoline, 4-stroke, and 2-stroke, used within an equipment type. Consequently, EPA estimated activity levels by *equipment* type, while applying emission factors appropriate to corresponding *engine* types.

EPA developed the ten equipment categories listed in Table 2-02. The primary purpose of equipment categories is to simplify the distribution of equipment populations and annual usage to the local nonattainment area level. Over 80 different types of equipment were considered in this analysis, many of which are highly specialized and have low sales

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[‡‡‡‡‡] Note that EPA used grams/hour emission factors for most recreational equipment and grams/gallon of fuel for recreational and commercial marine equipment.

volumes. EPA recognizes that many of the 80 equipment types, such as chain saws, generator sets, forklifts, and crawler tractors, are used in more than one industry or application (e.g., farming, construction, general industry or recreation) and that, consequently, the ten equipment categories are not mutually exclusive with respect to equipment type. Nevertheless, the definition of the ten categories is consistent with the methodology used to distribute equipment populations geographically and to estimate activity levels, and so it is considered to be valid for that purpose. Equipment types used for similar purposes were grouped into categories and a methodology was developed for distributing state or national population data to the local level for each equipment category. While these categories were used for distributing population data, activity levels were developed for each equipment type. Grouping equipment types into categories also provides a convenient means of reporting the results in a format which is more readily understood.[§§§§§] A detailed list of equipment types included in each equipment category is found in Appendix H.

Table 2-02. Nonroad Mobile Source Equipment Categories.

Equipment Category	Examples of Included Types of Equipment
Lawn and Garden	lawnmowers, snowblowers, trimmers, tillers, chain saws < 4 hp
Airport Service	aircraft and baggage towing tractors, airport service vehicles
Recreational	ATVs, off-road motorcycles, golf carts, snowmobiles
Recreational Marine	inboard and outboard recreational boats
Light Commercial	air and gas compressors, welders, generator sets, pumps
Industrial	aerial lifts, forklifts, self-propelled elevating platforms, sweepers
Construction	asphalt pavers, rollers, scrapers, rubber-tired dozers
Agricultural	agricultural tractors, combines, balers, harvesters
Logging	chain saws > 4 hp, delimbers, log skidders
Commercial Marine	harbor vessels, fishing vessels, ocean-going commercial vessels

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[§§§§§] These categories are neither definitions of "farm equipment" or "construction equipment" (terms that will be defined by EPA in a future rulemaking) nor necessarily appropriate for the classification of new nonroad engines and new nonroad vehicles for which regulations may be promulgated under section 213(a)(3) or 213(a)(4) of the CAA.

For the categories in Table 2-02, EPA developed separate emission factors for equipment types using diesel, gasoline 4-stroke, and 2-stroke and LPG engines where appropriate. A detailed discussion of the development of emission factors is contained in Appendix I.

2.3. Development of Emission Factors

A key element necessary to determine emission inventories for nonroad sources is the emission factor. An emission factor is the average emission rate when a vehicle or unit of equipment is operated in an average manner. Emission factors are commonly mass-based and expressed in units of mass per unit of work (e.g., grams per horsepower hour), mass per unit of fuel consumed, or, in the case of on-highway vehicles, mass per mile traveled.

For this study, Inventories A and B were calculated with a common set of emission factors, except for diesel particulate emission factors, which are different for the two inventories. A list of the emission factors selected by EPA is presented in "2.7. Comparison of Data Used in Inventories A and B." Emission factors for Inventory C required special aggregation to be compatible with SIP guidance.

EPA used data available from past studies and testing, as well as new information supplied by the engine manufacturers, to develop emission factors for tailpipe exhaust, refueling, evaporative, and crankcase emissions.[eeeee] Appendix I describes the various methodologies used to determine and select the most appropriate emission factors for each type of equipment. The emission factors developed for this study were reviewed by the technical review group.

The test data on which the emission factors are based consist almost exclusively of tests on new engines. While more testing needs to be completed before in-use emissions can be fully characterized, EPA believes that inventories incorporating emission factors based

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[eeeee] EPA contracted with Southwest Research Institute (SwRI) to perform a study to recommend categorization of nonroad sources and the best available exhaust emission factors for nonroad sources. SwRI completed this task in two parts. The first part focused on emission factors for VOC, CO, and NO_X, while the second part focused on particulate matter and air toxic emission factors. The final reports, "Non-Road Emission Factors Interim Report" and "Non-Road Emission Factors of Air Toxics" can be found in the public docket (#A-91-24). Appendix I provides detail on emission factors and how they were used. EPA received emission factor information from a number of industry sources. Appendix J indicates the sources of additional data.

solely on new engine data would grossly understate the contribution of nonroad engines to air pollution. Therefore, to estimate the magnitude of the effect of in-use emissions, which includes engine malfunctions, improper maintenance, and engine wear, EPA also developed a second set of emission factors that takes into account these effects.

Two sources of data were used to estimate in-use adjustment factors. One source was recent testing of in-use small utility engines performed by Southwest Research Institute (SwRI) under contract by EPA. The limited testing that has been done thus far suggests that in-use emissions could be 2 times higher, for some engines, than the emission factors based on new engines. The second source of data was a joint Engine Manufacturers Association (EMA)/EPA program conducted in 1983 which developed in-use emission factors for heavy-duty diesel and heavy-duty gasoline engines. The data obtained from this program suggests that, while in-use impacts are minimal for pre-controlled diesel engine emissions (i.e., diesel engine emissions do not increase with mileage/hours of operation), heavy-duty gasoline engine emissions increase with in-use operation. A detailed discussion of the in-use adjustments to emission factors is contained in Appendix I. Inventories A and B were calculated using both the new engine emission factors and the in-use emission factors. The results are presented so that the reader can clearly distinguish the estimated in-use portion of each inventory.

Another issue which is necessary to consider in the assessment of the magnitude of emission rates for nonroad equipment is whether the test cycle is representative of in-use operation. There is an ongoing debate regarding the appropriateness of using a steady state or a transient test cycle for testing the emissions of nonroad engines. This is an important issue, since measured emissions of most pollutants, especially particulate matter (PM), are sensitive to the test cycle. For instance, a steady state cycle used on a piece of equipment that experiences transient operation in-use may misrepresent the level of in-use emissions. EPA adjusted the PM, CO, and VOC emission factors which were developed using steady state procedures to account for in-use transient operation for those equipment types expected to encounter such operation. The equipment types that were adjusted are indicated by Footnote "a" in Table 2-07a. The adjustments were only made to diesel engines since the only data available was on diesel engines. A more detailed discussion of these adjustments for transient operation is contained in Appendix I.

2.4. Development of Activity Levels for Inventory A

Due to limitations in the existing guidance for developing emission inventories for nonroad mobile sources, EPA contracted to develop improved methodologies for all nonroad sources. The equipment populations, annual hours of use, average horsepower ratings, and load factors used in Inventory A are primarily based on a market research data base commercially available though Power Systems Research (PSR). This data base is continually updated through surveys of equipment manufacturers and end users. For the study, population data were disaggregated to individual nonattainment areas using commonly available economic indicators and census data.[******] The emissions analysis for commercial marine vessels was handled separately from other categories of equipment,[††††††] as discussed in Section 2.8.

The development of emission inventories for recreational boats relied on local registrations of pleasure craft. Because boats are often used outside areas where they are registered, adjustments to registration data were made based on a survey of boat owners in eight nonattainment areas conducted by Irwin Broh and Associates, Inc. for the National Marine Manufacturers Association (NMMA).[6] Annual fuel consumption from the same survey was also used in calculating recreational boat emissions.

While relying primarily on contractor input, EPA also used other data and information in calculating Inventory A. Documentation of adjustments to the contractor data are contained in Appendix K. Documentation of adjustments to the data to reflect variations in usage patterns by region of the country and season of the year is contained in Appendix L. Summaries of the data used to develop Inventory A are presented in "2.7. Comparison of Data Used in Inventories A and B," with more detailed information presented in Appendix M.

[******] The methodology is documented in the Energy and Environmental Analysis final report entitled "Methodology to Estimate Nonroad Equipment Populations by Nonattainment Areas," available for review in Docket #A-91-24.

[††††††] This is due to the fact that the types of commercial marine vessels are not as diverse as other nonroad categories, and to the fact that records of specific levels and types of vessel activities are more readily available.

2.5. Development of Activity Levels for Inventory B

In developing emission inventories for Inventory B, EPA incorporated data submitted by the following manufacturers and associations:

- Outdoor Power Equipment Institute - nonhandheld lawn and garden equipment
- Portable Power Equipment Manufacturers Association - handheld lawn and garden equipment
- Industrial Truck Association - forklifts
- Equipment Manufacturers Institute - agricultural and construction equipment
- National Marine Manufacturers Association - recreational marine equipment
- International Snowmobile Industry Association - snowmobiles
- Motorcycle Industry Council - ATVs, off-road motorcycles

Some of the equipment populations used in Inventory B were based on confidential sales data that are not commercially available. Where gaps existed, EPA used data from Inventory A; however, for most high volume categories the data used in Inventory B were submitted by manufacturers.

In some cases, it was necessary to adjust the data provided by manufacturers for use in constructing Inventory B. The use of and adjustment to manufacturer data is documented in Appendix N. EPA made seasonal adjustments to data in Inventory B similar to those made for Inventory A, as documented in Appendix L. In cases where manufacturers only supplied annual hours of use at the national level, these hours of use were used for all areas without regional adjustments. Summaries of the data used to develop Inventory B are presented in "2.7. Comparison of Data Used in Inventories A and B." More detailed information is presented in Appendix O.

2.6. Comparison of Results from October Draft and Final Study

EPA made some adjustments to the data used to construct Inventories A and B for this final report in response to public comments on the October draft study report. The most significant adjustments to Inventory B data impacting inventory results included revisions to the recreational marine inventory methodology, revisions to annual hours of use for lawnmowers, revisions to the methodology for distributing handheld equipment (trimmers, blowers, and chain saws) to the local level, revisions to population estimates for agricultural tractors and combines, and emission factors for outboard motors and crankcase emission from lawn and garden equipment. Some of these adjustment were also made to Inventory A, but with less impact on overall inventory results. A summary of the comments received to the October draft is in Appendix Q.

Charts 2-01 and 2-02 depict the results from Inventory A and Inventory B before and after adjustments were made to the draft results. Each chart shows the median local nonroad contributions to total VOC, NO_x, and CO inventories.

Chart 2-01. Median Contributions -- Draft Inventory A and B

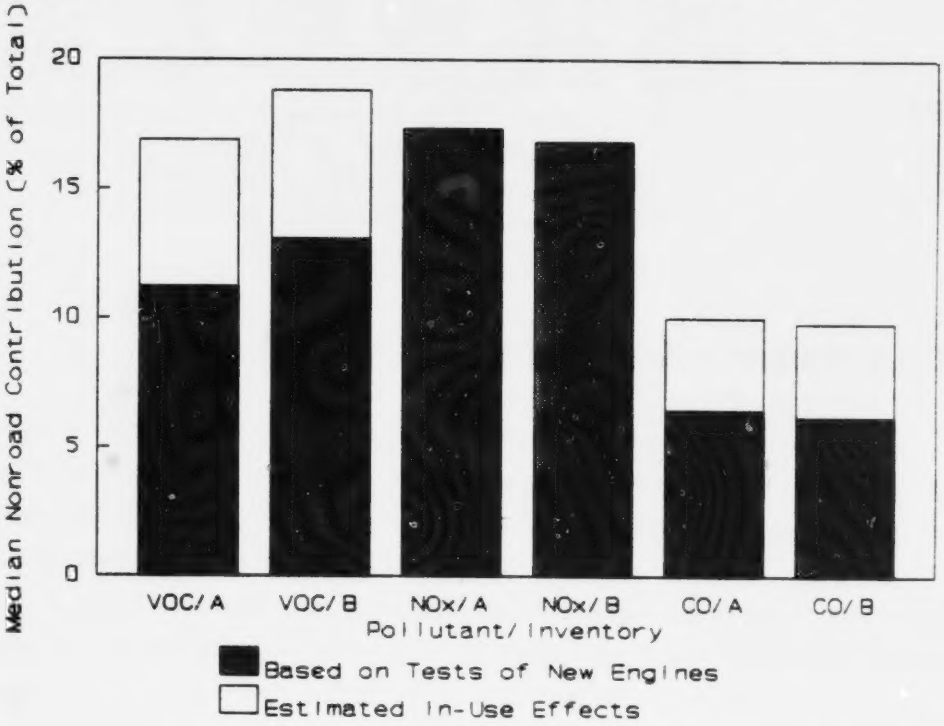
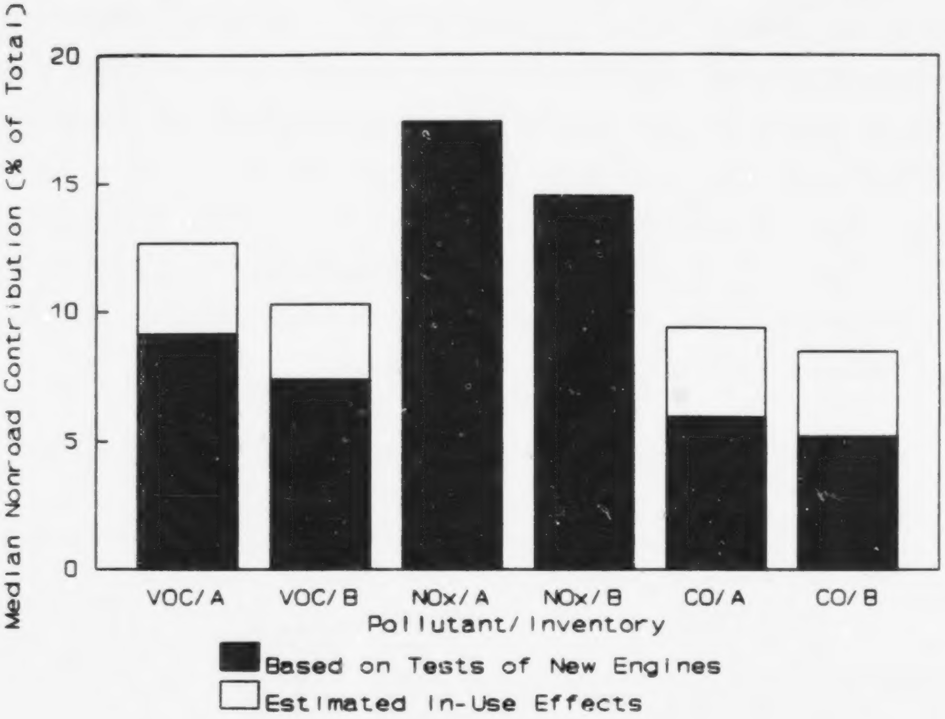


Chart 2-02. Median Contributions -- Final Inventory A and B



2.7. Comparison of Data Used in Inventories A and B

The national equipment population estimates used in constructing Inventories A and B are compared in Table 2-03. As discussed above, Inventory A incorporated population estimates developed by EPA contractors, while Inventory B incorporated, to the extent possible, data from manufacturer associations. Local population estimates used in developing Inventories A and B are included in *EPA Technical Memorandum - Nonroad Inventory Tables: Inventory A and B*, November 15, 1991. The equipment populations are presented by equipment and fuel type, including diesel, LPG/CNG, 4-stroke gasoline, and 2-stroke gasoline.

Comparisons of equipment horsepower and load factor estimates used in Inventory A and Inventory B are presented in Tables 2-04 and 2-05, respectively. Reported ranges of annual hours of use estimates, which vary by region, are compared in Table 2-06. Emission factors for diesel engines and gasoline 2- and 4-stroke engines, which were used in both Inventories A and B, are presented in Table 2-07. Seasonal adjustments, which were used in both Inventories A and B, are presented in Table 2-08, expressed in terms of the percentage of yearly activity occurring during summer and winter.

Table 2-03. Inventory A and B National Population Estimates

Class	National Populations Equipment Type	Diesel Inv. A	Diesel Inv. B	LPG/CNG Inv. A	LPG/CNG Inv. B	4-cycle gas Inv. A	4-cycle gas Inv. B	2-cycle gas Inv. A	2-cycle gas Inv. B	Total Inv. A	Total Inv. B
1	Trimmers/Edgers/Brush Cutters	0	0	0	0	21,921	21,921	18,150,361	13,561,414	18,172,282	13,583,335
1	Lawn Mowers	0	0	0	0	32,169,997	28,784,172	3,594,099	3,215,828	35,764,096	32,000,000
1	Leaf Blowers/Vacuums	0	0	0	0	228	228	2,025,558	2,870,936	2,025,786	2,871,164
1	Rear Engine Riding Mowers	8,713	9,460	0	0	1,575,407	1,710,540	0	0	1,584,120	1,720,000
1	Front Mowers	0	0	0	0	257,880	280,000	0	0	257,880	280,000
1	Chain Saws < 4 hp	0	0	0	0	0	0	16,124,970	7,895,502	16,124,970	7,895,502
1	Shredders < 5 hp	0	0	0	0	87,107	87,107	20,215	20,215	107,322	107,322
1	Tillers < 5 hp	0	0	0	0	3,794,457	2,724,966	17,543	12,598	3,812,000	2,737,564
1	Lawn and Garden Tractors	211,631	184,567	0	0	5,903,369	5,148,433	0	0	6,115,000	5,333,000
1	Wood Splitters	79	79	0	0	502,181	502,181	0	0	502,260	502,260
1	Snowblowers	0	0	0	0	3,537,376	3,537,376	1,244,624	1,244,624	4,782,000	4,782,000
1	Chippers/Stump Grinders	17,087	17,087	0	0	16,791	16,791	0	0	33,878	33,878
1	Commercial Turf Equipment	0	0	0	0	568,732	568,732	0	0	568,732	568,732
1	Other Lawn and Garden Equipment	180	180	0	0	285,909	285,909	110,545	110,545	396,634	396,634
2	Aircraft Support Equipment	9,529	9,529	0	0	2,767	2,767	0	0	12,296	12,296
2	Terminal Tractors	64,598	64,598	130	130	6,386	6,386	0	0	71,114	71,114
3	All Terrain Vehicles (ATVs)	0	0	0	0	1,180,001	1,180,001	132,980	132,980	1,312,981	1,312,981
3	Minibikes	0	0	0	0	48,990	48,990	0	0	48,990	48,990
3	Off-Road Motorcycles	0	0	0	0	63,348	63,348	137,777	137,777	201,125	201,125
3	Golf Carts	0	0	0	0	93,850	93,850	28,820	28,820	122,670	122,670
3	Snowmobiles	0	0	0	0	0	0	776,559	1,200,000	776,559	1,200,000
3	Specialty Vehicles Carts	3,344	3,344	0	0	91,026	91,026	175,070	175,070	269,440	269,440
4	Vessels w/Inboard Engines	73,945	73,945	0	0	436,018	436,018	0	0	509,962	509,962
4	Vessels w/Outboard Engines	0	0	0	0	41,228	41,228	8,204,304	8,204,304	8,245,531	8,245,531
4	Vessels w/Sterndrive Engines	0	0	0	0	2,713,420	2,713,420	0	0	2,713,420	2,713,420
4	Sailboat Auxiliary Inboard Engines	443,056	443,056	0	0	110,764	110,764	0	0	553,820	553,820
4	Sailboat Auxiliary Outboard Engines	0	0	0	0	3,738	3,738	141,152	141,152	144,890	144,890
5	Generator Sets < 50 hp	198,391	198,391	0		2,921,263	2,921,263	22,023	22,023	3,141,677	3,141,677
5	Pumps < 50 hp	61,810	61,810	91,234	91,234	560,451	560,451	0	0	713,498	713,498
5	Air Compressors < 50 hp	15,713	15,713	0	0	176,124	176,124	0	0	191,837	191,837
5	Gas Compressors< 50 hp	0	0	436	43	0	0	0	0	436	436
5	Welders < 50 hp	100,490	100,490	0	0	350,545	350,545	0	0	451,035	451,035
5	Pressure Washers< 50 hp	3,943	3,943	0	0	290,959	290,959	0	0	294,902	294,902
6	Aerial Lifts	12,310	12,310	3,407	3,407	24,981	24,981	0	0	40,698	40,698
6	Forklifts	160,583	47,068	82,117	191,327	100,365	120,557	0	0	343,065	358,952
6	Sweepers/Scrubbers	36,977	36,977	9,062	9,062	16,830	16,830	0	0	62,869	62,869
6	Other General Industrial Equipment	18,366	18,366	0	0	21,753	21,753	1,971	1,971	42,090	42,090
6	Other Material Handling Equipment	5,258	5,258	0	0	2,03	2,036	0	0	7,294	7,294
7	Asphalt Pavers	15,536	12,000	0	0	3,022			0	18,558	12,000

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Table 2-03 (Continued)

Class	National Populations Equipment Type	Diesel Inv. A	Diesel Inv. B	LPG/CNG Inv. A	LPG/CNG Inv. B	4-cycle gas Inv. A	4-cycle gas Inv. B	2-cycle gas Inv. A	2-cycle gas Inv. B	Total Inv. A	Total Inv. B
7	Tampers/Rammers	0	0	0	0	1,045	1,045	22,566	22,566	23,611	23,611
7	Plate Compactors	2,322	2,322	0	0	117,50	117,507	27,726	27,726	147,555	147,555
7	Concrete Pavers	5,511	8,400	0	0	0	0		0	5,511	8,400
7	Rollers	36,300	42,800	0	0	21,999		0	0	58,299	42,800
7	Scrapers	26,700	16,400	0	0	0	0		0	26,700	16,400
7	Paving Equipment	43,615	43,615	0	0	218,942	218,942	11,868	11,868	274,425	274,425
7	Surfacing Equipment	0	0	0	0	30,833	30,833	0	0	30,833	30,833
7	Signal Boards	20,384	20,384	0	0	1,559	1,559	0	0	21,943	21,943
7	Trenchers	50,510	53,390	0	0	27,170	27,170	0	0	77,680	80,560
7	Bore/Drill Rigs	7,761	7,761	0	0	8,395	8,395	10	106	16,262	16,262
7	Excavators	61,336	52,295	0	0	18		0	0	61,354	52,295
7	Concrete/Industrial Saws	135	61,336	0	0	36,900	36,900	0	0	37,035	98,236
7	Cement and Mortar Mixers	4,016	4,016	0	0	232,152	232,152	0	0	236,168	236,168
7	Cranes	98,357	98,357	0	0	2,541	2,541		0	100,898	100,898
7	Graders	70,045	64,000	0	0	0	0	0	0	70,045	64,000
7	Off-Highway Trucks	16,529	19,400	0	0	0		0	0	16,529	19,400
7	Crushing/Proc. Equipment	7,207	7,207	0	0	1,007	1,007	0	0	8,214	8,214
7	Rough Terrain Forklifts	53,853	25,132	0	0	2,217	2,217	0	0	56,070	27,349
7	Rubber Tired Loaders	209,454	130,000	0	0	3,433	0	0	0	212,887	130,000
7	Rubber Tired Dozers	7,757	7,757	0	0	0	0		0	7,757	7,757
7	Tractors/Loaders/Backhoes	299,265	189,000	0	0	1,365	0	0	0	300,630	189,000
7	Crawler Tractors	285,923	159,050	0	0	0	0	0	0	285,923	159,050
7	Skid Steer Loaders	150,054	140,000	0	0	27,805	0	0	0	177,859	140,000
7	Off-Highway Tractors	38,921	38,921	0	0	0	0	0	0	38,921	38,921
7	Dumpers/Tenders	194	194	0	0	24,301	24,301	0	0	24,495	24,495
7	Other Construction Equipment	11,867	11,867	0	0	1,103	1,103		0	12,970	12,970
8	2-Wheel Tractors	0	0	0	0	13,802	13,802	0	0	13,802	13,802
8	Agricultural Tractors	2,519,295	2,519,295	0	0	5,808	5,808	0	0	2,525,103	2,525,103
8	Combines	284,854	284,854	0	0	1,835	1,835	0	0	286,689	286,689
8	Sprayers	9,692	9,692	0	0	72,721	72,721	0	0	82,413	82,413
8	Balers	4,260	4,260	0	0	0	0	0	0	4,260	4,260
8	Tillers > 5 hp	78	29	0	0	783,102	562,407	0	0	783,180	562,436
8	Swathers	50,032	50,032	0	0	32,857	32,857	0	0	82,889	82,889
8	Hydro Power Units	2,366	2,366	0	0	15,042	15,042	0	0	17,408	17,408
8	Other Agricultural Equipment	18,042	18,042	0	0	6,405	6,405	0	0	24,447	24,447
9	Chain Saws > 4 hp	0	0	0	0	0	0	51,775	25,351	51,775	25,351
9	Shredders > 5 hp	0	0	0	0	100,271	100,271	0	0	100,271	100,271
9	Skidders	30,911	30,911	0	0	0	0	0	0	30,911	30,911
9	Fellers/Bunchers	15,581	15,581	0	0	0	0	0	0	15,581	15,581

Key:

1 = Lawn and Garden
2 = Airport Service
3 = Recreational Equipment
4 = Recreational Marine
5 = Light Commercial
6 = Industrial
7 = Construction
8 = Agricultural
9 = Logging

Table 2-04. Inventory A and B Average Rated Horsepower Estimates

Class	Horsepower Equipment Type		Diesel Inv. A	Diesel Inv. B	LPG/CNG Inv. A	LPG/CNG Inv. B	4-cycle gas Inv. A	4-cycle gas Inv. B	2-cycle gas Inv. A	2-cycle gas Inv. B
1	Trimmers/Edgers/Brush Cutters		NA	NA	NA	NA	1.0	1.3	1.0	1.3
1	Lawnmowers		NA	NA	NA	NA	4.0	3.8	4.0	3.8
1	Leaf Blowers/Vacuums		NA	NA	NA	NA	2.0	2.0	2.0	2.0
1	Rear Engine Riding Mowers		17.0	10.2	NA	NA	9.0	10.2	NA	NA
1	Front Mowers		NA	NA	NA	NA	12.0	13.3	NA	NA
1	Chain Saws	< 4 hp	NA	NA	NA	NA	NA	NA	2.0	3.2
1	Shredders	< 5 hp	NA	NA	NA	NA	4.0	4.0	4.0	4.0
1	Tillers	< 5 hp	NA	NA	NA	NA	4.0	4.3	4.0	4.3
1	Lawn and Garden Tractors		16.0	13.3	NA	NA	12.0	13.3	NA	NA
1	Wood Splitters		58.0	58.0	NA	NA	5.0	5.0	NA	NA
1	Snowblowers		NA	NA	NA	NA	6.0	5.1	6.0	3.8
1	Chippers/Stump Grinders		99.0	99.0	NA	NA	62.0	62.0	NA	NA
1	Commercial Turf Equipment		NA	NA	NA	NA	13.0	11.4	NA	NA
1	Other Lawn and Garden Equipment		18.0	18.0	NA	NA	3.0	3.0	3.0	3.0
2	Aircraft Support Equipment		137.0	137.0	NA	NA	48.0	48.0	NA	NA
2	Terminal Tractors		96.0	96.0	82.0	82.0	82.0	82.0	NA	NA
3	All Terrain Vehicles (ATVs)		NA	NA	NA	NA	NA	NA	NA	NA
3	Minibikes		NA	NA	NA	NA	NA	NA	NA	NA
3	Off-Road Motorcycles		NA	NA	NA	NA	NA	NA	NA	NA
3	Golf Carts		NA	NA	NA	NA	NA	NA	NA	NA
3	Snowmobiles		NA	NA	NA	NA	NA	NA	26.0	26.0
3	Specialty Vehicles Carts		NA	NA	NA	NA	NA	NA	NA	NA
4	Vessels w/Inboard Engines		NA	NA	NA	NA	NA	NA	NA	NA
4	Vessels w/Outboard Engines		NA	NA	NA	NA	NA	NA	NA	NA
4	Vessels w/Sterndrive Engines		NA	NA	NA	NA	NA	NA	NA	NA
4	Sailboat Auxiliary Inboard Engines		NA	NA	NA	NA	NA	NA	NA	NA
4	Sailboat Auxiliary Outboard Engines		NA	NA	NA	NA	NA	0.0	NA	0.0
5	Generator Sets	< 50 hp	22.0	22.0	NA	NA	11.0	11.0	11.0	11.0
5	Pumps	< 50 hp	23.0	23.0	7.0	7.0	7.0	7.0	NA	NA
5	Air Compressors	< 50 hp	37.0	37.0	NA	NA	9.0	9.0	NA	NA
5	Gas Compressors	< 50 hp	NA	NA	30.0	30.0	NA	NA	NA	NA
5	Welders	< 50 hp	35.0	35.0	NA	NA	19.0	19.0	NA	NA
5	Pressure Washers	< 50 hp	21.0	21.0	NA	NA	7.0	7.0	NA	NA
6	Aerial Lifts		43.0	35.0	36.0	36.0	36.0	36.0	NA	NA
6	Forklifts		83.0	83.0	62.0	62.0	62.0	62.0	NA	NA
6	Sweepers/Scrubbers		97.0	97.0	39.0	39.0	39.0	39.0	NA	NA
6	Other General Industrial Equipment		107.0	107.0	NA	NA	19.0	19.0	19.0	19.0
6	Other Material Handling Equipment		111.0	111.0	NA	NA	51.0	51.0	NA	NA
7	Asphalt Pavers		91.0	77.0	NA	NA	31.0	NA	NA	NA
7	Tampers/Rammers		NA	NA	NA	NA	4.0	4.0	4.0	4.0
7	Plate Compactors		8.0	8.0	NA	NA	5.0	5.0	5.0	5.0
7	Concrete Pavers		130.0	77.0	NA	NA	NA	NA	NA	NA
7	Rollers		99.0	99.0	NA	NA	17.0	NA	NA	NA
7	Scrapers		311.0	290.0	NA	NA	NA	NA	NA	NA
7	Paving Equipment		99.0	99.0	NA	NA	7.0	7.0	7.0	7.0
7	Surfacing Equipment		NA	NA	NA	NA	8.0	8.0	NA	NA

Table 2-04 (Continued)

Class	Horsepower Equipment Type		Diesel Inv. A	Diesel Inv. B	LPG/CNG Inv. A	LPG/CNG Inv. B	4-cycle gas Inv. A	4-cycle gas Inv. B	2-cycle gas Inv. A	2-cycle gas Inv. B
7	Signal Boards		6.0	6.0	NA	NA	8.0	8.0	NA	NA
7	Trenchers		60.0	27.0	NA	NA	27.0	27.0	NA	NA
7	Bore/Drill Rigs		209.0	209.0	NA	NA	54.0	54.0	54.0	54.0
7	Excavators		183.0	143.0	NA	NA	80.0	NA	NA	NA
7	Concrete/Industrial Saws		56.0	56.0	NA	NA	13.0	13.0	NA	NA
7	Cement and Mortar Mixers		11.0	11.0	NA	NA	7.0	7.0	NA	NA
7	Cranes		194.0	194.0	NA	NA	55.0	55.0	NA	NA
7	Graders		172.0	147.0	NA	NA	NA	NA	NA	NA
7	Off-Highway Trucks		489.0	658.0	NA	NA	NA	NA	NA	NA
7	Crushing/Proc. Equipment		127.0	127.0	NA	NA	60.0	60.0	NA	NA
7	Rough Terrain Forklifts		93.0	84.0	NA	NA	88.0	88.0	NA	NA
7	Rubber Tired Loaders		158.0	175.0	NA	NA	67.0	NA	NA	NA
7	Rubber Tired Dozers		356.0	356.0	NA	NA	NA	NA	NA	NA
7	Tractors/Loaders/Backhoes		77.0	71.0	NA	NA	63.0	NA	NA	NA
7	Crawler Tractors		157.0	134.0	NA	NA	NA	NA	NA	NA
7	Skid Steer Loaders		42.0	44.0	NA	NA	33.0	NA	NA	NA
7	Off-Highway Tractors		214.0	214.0	NA	NA	NA	NA	NA	NA
7	Dumpers/Tenders		23.0	23.0	NA	NA	9.0	9.0	NA	NA
7	Other Construction Equipment		161.0	161.0	NA	NA	150.0	150.0	NA	NA
8	2-Wheel Tractors		NA	NA	NA	NA	7.0	7.0	NA	NA
8	Agricultural Tractors		98.0	98.0	NA	NA	87.0	87.0	NA	NA
8	Agricultural Mowers		NA	NA	NA	NA	11.0	11.0	NA	NA
8	Combines		152.0	152.0	NA	NA	131.0	131.0	NA	NA
8	Sprayers		92.0	92.0	NA	NA	24.0	24.0	NA	NA
8	Balers		74.0	98.0	NA	NA	NA	NA	NA	NA
8	Tillers	> 5 hp	7.0	7.0	NA	NA	7.0	5.6	NA	NA
8	Swathers		79.0	82.0	NA	NA	106.0	106.0	NA	NA
8	Hydro Power Units		35.0	35.0	NA	NA	14.0	14.0	NA	NA
8	Other Agricultural Equipment		57.0	57.0	NA	NA	55.0	55.0	NA	NA
9	Chain Saws	> 4 hp	NA	NA	NA	NA	NA	NA	6.0	6.4
9	Shredders	> 5 hp	NA	NA	NA	NA	8.0	8.0	NA	NA
9	Skidders		150.0	131.0	NA	NA	NA	NA	NA	NA
9	Fellers/Bunchers		183.0	183.0	NA	NA	NA	NA	NA	NA
NA = Not applicable										

Key:

1 = Lawn and Garden
2 = Airport Service
3 = Recreational Equipment
4 = Recreational Marine
5 = Light Commercial
6 = Industrial
7 = Construction
8 = Agricultural
9 = Logging

NA = Not applicable

Table 2-05. Inventory A and B Typical Operating Load Factor Estimates

Class	Load Factors Equipment Type	Diesel Inv. A	Diesel Inv. B	LPG/CNG Inv. A	LPG/CNG Inv. B	4-cycle gas Inv. A	4-cycle gas Inv. B	2-cycle gas Inv. A	2-cycle gas Inv. B
1	Trimmers/Edgers/Brush Cutters	NA	NA	NA	NA	36%	36%	50%	50%
1	Lawnmowers	NA	NA	NA	NA	36%	30%	36%	30%
1	Leaf Blowers/Vacuums	NA	NA	NA	NA	36%	36%	50%	50%
1	Rear Engine Riding Mowers	38%	38%	NA	NA	38%	38%	NA	NA
1	Front Mowers	NA	NA	NA	NA	50%	38%	NA	NA
1	Chain Saws < 4 hp	NA	NA	NA	NA	NA	NA	50%	50%
1	Shredders < 5 hp	NA	NA	NA	NA	36%	36%	36%	36%
1	Tillers < 5 hp	NA	NA	NA	NA	40%	40%	40%	40%
1	Lawn and Garden Tractors	50%	38%	NA	NA	50%	38%	NA	NA
1	Wood Splitters	50%	50%	NA	NA	50%	50%	NA	NA
1	Snowblowers	NA	NA	NA	NA	35%	35%	35%	35%
1	Chippers/Stump Grinders	37%	37%	NA	NA	39%	39%	NA	NA
1	Commercial Turf Equipment	NA	NA	NA	NA	50%	50%	NA	NA
1	Other Lawn and Garden Equipment	50%	50%	NA	NA	50%	50%	50%	50%
2	Aircraft Support Equipment	51%	51%	NA	NA	56%	56%	NA	NA
2	Terminal Tractors	82%	82%	78%	78%	78%	78%	NA	NA
3	All Terrain Vehicles (ATVs)	NA	NA	NA	NA	NA	NA	NA	NA
3	Minibikes	NA	NA	NA	NA	NA	NA	NA	NA
3	Off-Road Motorcycles	NA	NA	NA	NA	NA	NA	NA	NA
3	Golf Carts	NA	NA	NA	NA	NA	NA	NA	NA
3	Snowmobiles	NA	NA	NA	NA	NA	NA	81%	81%
3	Specialty Vehicles Carts	NA	NA	NA	NA	NA	NA	NA	NA
4	Vessels w/Inboard Engines	NA	NA	NA	NA	NA	NA	NA	NA
4	Vessels w/Outboard Engines	NA	NA	NA	NA	NA	NA	NA	NA
4	Vessels w/Sterndrive Engines	NA	NA	NA	NA	NA	NA	NA	NA
4	Sailboat Auxiliary Inboard Engines	NA	NA	NA	NA	NA	NA	NA	NA
4	Sailboat Auxiliary Outboard Engines	NA	NA	NA	NA	NA	NA	NA	NA
5	Generator Sets < 50 hp	74%	74%	NA	NA	68%	68%	68%	68%
5	Pumps < 50 hp	74%	74%	69%	69%	69%	69%	NA	NA
5	Air Compressors < 50 hp	48%	48%	NA	NA	56%	56%	NA	NA
5	Gas Compressors < 50 hp	NA	NA	60%	60%	NA	NA	NA	NA
5	Welders < 50 hp	45%	45%	NA	NA	51%	51%	NA	NA
5	Pressure Washers < 50 hp	30%	30%	NA	NA	85%	85%	NA	NA
6	Aerial Lifts	46%	55%	46%	46%	46%	46%	NA	NA
6	Forklifts	30%	30%	30%	30%	30%	30%	NA	NA
6	Sweepers/Scrubbers	68%	68%	71%	71%	71%	71%	NA	NA
6	Other General Industrial Equipment	51%	51%	NA	NA	54%	54%	54%	54%
6	Other Material Handling Equipment	59%	59%	NA	NA	53%	53%	NA	NA
7	Asphalt Pavers	62%	56%	NA	NA	66%	NA	NA	NA
7	Tampers/Rammers	NA	NA	NA	NA	55%	55%	55%	55%
7	Plate Compactors	43%	43%	NA	NA	55%	55%	55%	55%
7	Concrete Pavers	68%	56%	NA	NA	NA	NA	NA	NA
7	Rollers	56%	59%	NA	NA	62%	NA	NA	NA
7	Scrapers	72%	60%	NA	NA	NA	NA	NA	NA
7	Paving Equipment	53%	53%	NA	NA	59%	59%	59%	59%
7	Surfacing Equipment	NA	NA	NA	NA	49%	49%	NA	NA

Table 2-05 (Continued)

Class	Load Factors Equipment Type	Diesel Inv. A	Diesel Inv. B	LPG/CNG Inv. A	LPG/CNG Inv. B	4-cycle gas Inv. A	4-cycle gas Inv. B	2-cycle gas Inv. A	2-cycle gas Inv. B
7	Signal Boards	82%	82%	NA	NA	76%	76%	NA	NA
7	Trenchers	75%	64%	NA	NA	66%	0%	NA	NA
7	Bore/Drill Rigs	75%	75%	NA	NA	79%	79%	79%	79%
7	Excavators	57%	59%	NA	NA	53%	NA	NA	NA
7	Concrete/Industrial Saws	73%	73%	NA	NA	78%	78%	NA	NA
7	Cement and Mortar Mixers	56%	56%	NA	NA	59%	59%	NA	NA
7	Cranes	43%	43%	NA	NA	47%	47%	NA	NA
7	Graders	61%	54%	NA	NA	NA	NA	NA	NA
7	Off-Highway Trucks	57%	25%	NA	NA	NA	NA	NA	NA
7	Crushing/Proc. Equipment	78%	78%	NA	NA	85%	85%	NA	NA
7	Rough Terrain Forklifts	60%	33%	NA	NA	63%	63%	NA	NA
7	Rubber Tired Loaders	54%	54%	NA	NA	54%	NA	NA	NA
7	Rubber Tired Dozers	59%	59%	NA	NA	NA	NA	NA	NA
7	Tractors/Loaders/Backhoes	55%	38%	NA	NA	48%	NA	NA	NA
7	Crawler Tractors	58%	57%	NA	NA	NA	NA	NA	NA
7	Skid Steer Loaders	55%	48%	NA	NA	58%	NA	NA	NA
7	Off-Highway Tractors	65%	65%	NA	NA	NA	NA	NA	NA
7	Dampers/Tenders	38%	38%	NA	NA	41%	41%	NA	NA
7	Other Construction Equipment	62%	62%	NA	NA	48%	48%	NA	NA
8	2-Wheel Tractors	NA	NA	NA	NA	62%	62%	NA	NA
8	Agricultural Tractors	70%	70%	NA	NA	62%	62%	NA	NA
8	Agricultural Mowers	NA	NA	NA	NA	48%	48%	NA	NA
8	Combines	70%	70%	NA	NA	74%	74%	NA	NA
8	Sprayers	50%	50%	NA	NA	50%	50%	NA	NA
8	Balers	58%	58%	NA	NA	NA	NA	NA	NA
8	Tillers > 5 hp	78%	40%	NA	NA	71%	40%	NA	NA
8	Swathers	55%	62%	NA	NA	52%	52%	NA	NA
8	Hydro Power Units	48%	48%	NA	NA	56%	56%	NA	NA
8	Other Agricultural Equipment	51%	51%	NA	NA	55%	55%	NA	NA
9	Chain Saws > 4 hp	NA	NA	NA	NA	NA	NA	92%	50%
9	Shredders > 5 hp	NA	NA	NA	NA	80%	30%	NA	NA
9	Skidders	74%	49%	NA	NA	NA	NA	NA	NA
9	Fellers/Bunchers	71%	71%	NA	NA	NA	NA	NA	NA

NA = Not applicable

Key:

1 = Lawn and Garden
2 = Airport Service
3 = Recreational Equipment
4 = Recreational Marine
5 = Light Commercial
6 = Industrial
7 = Construction
8 = Agricultural
9 = Logging

NA = Not applicable

Table 2-06. Inventory A and B Annual Use Estimates

Class	Hours/Year (* = Gallons/Year) Equipment Type	Diesel Inv. A	Diesel Inv. B	LPG/CNG Inv. A	LPG/CNG Inv. B	4-cycle gas Inv. A	4-cycle gas Inv. B	2-cycle gas Inv. A	2-cycle gas Inv. B
1	Trimmers/Edgers/Brush Cutters	NA	NA	NA	NA	8-21	19-19	8-21	19-19
1	Lawnmowers	NA	NA	NA	NA	27-73	33-49	33-91	41-61
1	Leaf Blowers/Vacuums	NA	NA	NA	NA	7-20	25-25	7-20	25-25
1	Rear Engine Riding Mowers	22-50	28-45	NA	NA	22-50	28-45	NA	NA
1	Front Mowers	NA	NA	NA	NA	25-46	28-45	NA	NA
1	Chain Saws < 4 hp	NA	NA	NA	NA	NA	NA	13-21	23-23
1	Shredders < 5 hp	NA	NA	NA	NA	3-5	75-75	3-5	3-5
1	Tillers < 5 hp	NA	NA	NA	NA	16-25	27-31	16-25	27-31
1	Lawn and Garden Tractors	173-340	37-340	NA	NA	33-65	35-65	NA	NA
1	Wood Splitters	64-95	64-95	NA	NA	18-27	18-27	NA	NA
1	Snowblowers	NA	NA	NA	NA	8-18	8-18	8-18	8-18
1	Chippers/Stump Grinders	367-525	367-525	NA	NA	386-551	386-551	NA	NA
1	Commercial Turf Equipment	NA	NA	NA	NA	410-931	410-931	NA	NA
1	Other Lawn and Garden Equipment	101-197	101-197	NA	NA	14-28	14-28	14-28	14-28
2	Aircraft Support Equipment	651-856	651-856	NA	NA	606-797	606-797	NA	NA
2	Terminal Tractors	1081-1433	1081-1433	711-943	711-943	711-943	711-943	NA	NA
3	All Terrain Vehicles (ATVs)	NA	NA	NA	NA	88-142	9-15	88-142	9-15
3	Minibikes	NA	NA	NA	NA	25-67	9-15	NA	NA
3	Off-Road Motorcycles	NA	NA	NA	NA	62-139	9-15	62-139	9-15
3	Golf Carts	NA	NA	NA	NA	637-1231	637-1231	637-1231	637-1231
3	Snowmobiles	NA	NA	NA	NA	NA	NA	77-189	90-90
3	Specialty Vehicles Carts	370-496	370-496	NA	NA	55-74	55-74	55-74	55-74
4	Vessels w/Inboard Engines < 250 hp*	343-959	100-1183	NA	NA	187-524	93-637	NA	NA
4	Vessels w/Outboard Engines*	NA	NA	NA	NA	69-134	63-213	110-214	63-213
4	Vessels w/Sterndrive Engines*	NA	NA	NA	NA	206-576	168-416	NA	NA
4	Sailboat Auxiliary Inboard Engines*	17-50	12-102	NA	NA	9-28	19-55	NA	NA
4	Sailboat Auxiliary Outboard Engines*	NA	NA	NA	NA	4-8	2-54	7-14	2-54
5	Generator Sets < 50 hp	345-483	345-483	NA	NA	117-164	117-164	117-164	117-164
5	Pumps < 50 hp	318-488	318-488	175-267	175-267	175-267	175-267	NA	NA
5	Air Compressors < 50 hp	595-954	595-954	NA	NA	353-566	353-566	NA	NA
5	Gas Compressors < 50 hp	NA	NA	8500-8500	8500-8500	NA	NA	NA	NA
5	Welders < 50 hp	418-759	418-759	NA	NA	135-245	135-245	NA	NA
5	Pressure Washers < 50 hp	93-183	93-183	NA	NA	74-145	74-145	NA	NA
6	Aerial Lifts	265-407	2053-2587	249-383	2053-2587	249-383	2053-2587	NA	NA
6	Forklifts	1513-1751	850-850	1602-1854	850-850	1602-1854	850-850	NA	NA
6	Sweepers/Scrubbers	1183-1318	1183-1318	501-557	501-557	501-557	501-557	NA	NA
6	Other General Industrial Equipment	571-1089	571-1089	NA	NA	463-884	463-884	463-884	463-884
6	Other Material Handling Equipment	366-463	366-463	NA	NA	336-425	336-425	NA	NA
7	Asphalt Pavers	534-846	594-1016	NA	NA	255-404	NA	NA	NA
7	Tampers/Rammers	NA	NA	NA	NA	110-186	110-186	110-186	110-186
7	Plate Compactors	286-610	286-610	NA	NA	98-209	98-209	98-209	98-209
7	Concrete Pavers	534-854	594-1016	NA	NA	NA	NA	NA	NA
7	Rollers	454-775	647-1016	NA	NA	379-646	NA	NA	NA

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Table 2-06 (Continued)

Class	Hours/Year (* = Gallons/Year) Equipment Type	Diesel Inv. A	Diesel Inv. B	LPG/CNG Inv. A	LPG/CNG Inv. B	4-cycle gas Inv. A	4-cycle gas Inv. B	2-cycle gas Inv. A	2-cycle gas Inv. B
7	Scrapers	667-1024	667-1647	NA	NA	NA	NA	NA	NA
7	Paving Equipment	348-722	348-722	NA	NA	98-203	98-203	98-203	98-203
7	Surfacing Equipment	NA	NA	NA	NA	278-512	278-512	NA	NA
7	Signal Boards	448-978	448-978	NA	NA	133-289	133-289	NA	NA
7	Trenchers	409-652	267-593	NA	NA	277-442	0-402	NA	NA
7	Bore/Drill Rigs	261-550	261-550	NA	NA	60-126	60-126	60-126	60-126
7	Excavators	593-911	1051-1358	NA	NA	261-401	NA	NA	NA
7	Concrete/Industrial Saws	400-603	400-603	NA	NA	421-634	421-634	NA	NA
7	Cement and Mortar Mixers	157-305	157-305	NA	NA	48-93	48-93	NA	NA
7	Cranes	629-814	629-814	NA	NA	324-419	324-419	NA	NA
7	Graders	591-837	811-1110	NA	NA	NA	NA	NA	NA
7	Off-Highway Trucks	1149-1871	1149-3951	NA	NA	NA	NA	NA	NA
7	Crushing/Proc. Equipment	592-1165	592-1165	NA	NA	149-294	149-294	NA	NA
7	Rough Terrain Forklifts	410-775	662-1024	NA	NA	256-483	NA	NA	NA
7	Rubber Tired Loaders	624-890	1191-1587	NA	NA	420-599	NA	NA	NA
7	Rubber Tired Dozers	647-1034	647-1034	NA	NA	NA	NA	NA	NA
7	Tractors/Loaders/Backhoes	772-1203	653-797	NA	NA	592-922	NA	NA	NA
7	Crawler Tractors	655-1067	871-1422	NA	NA	NA	NA	NA	NA
7	Skid Steer Loaders	524-859	615-730	NA	NA	198-326	NA	NA	NA
7	Off-Highway Tractors	778-992	778-992	NA	NA	NA	NA	NA	NA
7	Dumpers/Tenders	266-685	266-685	NA	NA	60-154	60-154	NA	NA
7	Other Construction Equipment	388-624	388-624	NA	NA	237-382	237-382	NA	NA
8	2-Wheel Tractors	NA	NA	NA	NA	177-346	177-346	NA	NA
8	Agricultural Tractors	309-542	309-542	NA	NA	358-627	358-627	NA	NA
8	Agricultural Mowers	NA	NA	NA	NA	82-250	82-250	NA	NA
8	Combines	74-186	74-186	NA	NA	61-155	61-155	NA	NA
8	Sprayers	53-121	53-121	NA	NA	47-107	47-107	NA	NA
8	Balers	52-142	308-308	NA	NA	NA	NA	NA	NA
8	Tillers > 5 hp	188-289	61-68	NA	NA	47-72	27-31	NA	NA
8	Swathers	52-139	100-539	NA	NA	45-120	0-100	NA	NA
8	Hydro Power Units	600-830	600-830	NA	NA	342-473	342-473	NA	NA
8	Other Agricultural Equipment	236-453	236-446	NA	NA	77-148	77-148	NA	NA
9	Chain Saws > 4 hp	NA	NA	NA	NA	NA	NA	142-228	405-405
9	Shredders > 5 hp	NA	NA	NA	NA	136-252	75-75	NA	NA
9	Skidders	994-1413	994-1454	NA	NA	NA	NA	NA	NA
9	Fellers/Bunchers	880-1467	880-1467	NA	NA	NA	NA	NA	NA

NA = Not applicable
* = Values reported are gallons/year - not hours/year

Key:

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2 = Airport Service
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NA = Not applicable

Table 2-07. Emission Factors for Inventories A and B

a. DIESEL EQUIPMENT (grams/hp-hr)

Class	Equipment Types		HC				CO	NO_x	PM	Aldehydes	SO_x
			Exhaust	Crank	Evap*	Refueling					
1	Trimmers/Edgers/Brush Cutters		NA	NA	NA	NA	NA	NA	NA	NA	NA
1	Lawnmowers		NA	NA	NA	NA	NA	NA	NA	NA	NA
1	Leaf Blowers/Vacuums		NA	NA	NA	NA	NA	NA	NA	NA	NA
1	Rear Engine Riding Mowers		1.20	0.02	NA	0.005	5.00	8.00	1.00	0.06	0.93
1	Front Mowers		NA	NA	NA	NA	NA	NA	NA	NA	NA
1	Chain Saws < 4 hp		NA	NA	NA	NA	NA	NA	NA	NA	NA
1	Shredders < 5 hp		NA	NA	NA	NA	NA	NA	NA	NA	NA
1	Tillers < 5 hp		NA	NA	NA	NA	NA	NA	NA	NA	NA
1	Lawn and Garden Tractors		1.20	0.02	NA	0.005	5.00	8.00	1.00	0.06	0.93
1	Wood Splitters		1.20	0.02	NA	0.003	5.00	8.00	1.00	0.06	0.93
1	Snowblowers		NA	NA	NA	NA	NA	NA	NA	NA	NA
1	Chippers/Stump Grinders		1.20	0.02	NA	0.003	5.00	8.00	1.00	0.06	0.93
1	Commercial Turf Equipment		NA	NA	NA	NA	NA	NA	NA	NA	NA
1	Other Lawn and Garden Equipment		1.20	0.02	NA	0.005	5.00	8.00	1.00	0.06	0.93
2	Aircraft Support Equipment	a	1.57	0.03	NA	0.003	6.06	14.00	1.60	0.06	0.93
2	Terminal Tractors	a	1.57	0.03	NA	0.003	6.06	14.00	1.60	0.06	0.93
3	All Terrain Vehicles (ATVs)	*	NA	NA	NA	NA	NA	NA	NA	NA	NA
3	Minibikes	*	NA	NA	NA	NA	NA	NA	NA	NA	NA
3	Off-Road Motorcycles	*	NA	NA	NA	NA	NA	NA	NA	NA	NA
3	Golf Carts	*	NA	NA	NA	NA	NA	NA	NA	NA	NA
3	Snowmobiles		NA	NA	NA	NA	NA	NA	NA	NA	NA
3	Specialty Vehicles Carts	*	1.20	0.02	NA	0.350	5.00	8.00	1.00	0.06	0.93
4	Vessels w/Inboard Engines	**	24.39	NA	NA	0.040	37.01	172.49	10.89	0.92	12.20
4	Vessels w/Outboard Engines	**	24.39	0.49	NA	0.000	37.01	172.49	10.89	0.92	12.20
4	Vessels w/Sterndrive Engines	**	24.39	NA	NA	0.000	37.01	172.49	10.89	0.92	12.20
4	Sailboat Auxiliary Inboard Engines	**	122.45	NA	NA	0.040	217.72	163.29	10.89	0.92	12.20
4	Sailboat Auxiliary Outboard Engines	**	122.45	2.45	NA	0.040	217.72	163.29	10.89	0.92	12.20
5	Generator Sets < 50 hp		1.20	0.02	NA	0.003	5.00	8.00	1.00	0.06	0.93
5	Pumps < 50 hp		1.20	0.02	NA	0.003	5.00	8.00	1.00	0.06	0.93
5	Air Compressors < 50 hp		1.20	0.02	NA	0.003	5.00	8.00	1.00	0.06	0.93
5	Gas Compressors < 50 hp		NA	NA	NA	NA	NA	NA	NA	NA	NA
5	Welders < 50 hp		1.20	0.02	NA	0.003	5.00	8.00	1.00	0.06	0.93
5	Pressure Washers < 50 hp		1.20	0.02	NA	0.003	5.00	8.00	1.00	0.06	0.93
6	Aerial Lifts	a	1.57	0.03	NA	0.003	6.06	14.00	1.60	0.21	0.93
6	Forklifts	a	1.57	0.03	NA	0.003	6.06	14.00	1.60	0.21	0.93
6	Sweepers/Scrubbers	a	1.57	0.03	NA	0.003	6.06	14.00	1.60	0.21	0.93
6	Other General Industrial Equipment	a	1.57	0.03	NA	0.003	6.06	14.00	1.60	0.21	0.93
6	Other Material Handling Equipment	a	1.57	0.03	NA	0.003	6.06	14.00	1.60	0.21	0.93
7	Asphalt Pavers		0.60	0.01	NA	0.003	3.20	10.30	0.90	0.20	0.93
7	Tampers/Rammers		0.00	0.00	NA	NA	0.00	0.00	0.00	0.00	0.00
7	Plate Compactors		0.80	0.02	NA	0.007	3.10	9.30	0.90	0.20	0.93
7	Concrete Pavers		1.10	0.02	NA	0.003	4.57	10.02	0.90	0.20	0.93

Table 2-07a. (Continued)

Class	Equipment Types		HC				CO	NO$_x$	PM	Aldehydes	SO$_x$
			Exhaust	Crank	Evap*	Refueling					
7	Rollers		0.80	0.02	NA	0.003	3.10	9.30	0.78	0.20	1.00
7	Scrapers	a	0.70	0.01	NA	0.003	5.00	8.70	1.26	0.28	0.90
7	Paving Equipment		1.01	0.02	NA	0.003	4.60	11.01	0.90	0.20	0.93
7	Surfacing Equipment		0.00	0.00	NA	NA	0.00	0.00	0.00	0.00	0.00
7	Signal Boards		1.20	0.02	NA	0.007	5.00	8.00	1.00	0.20	0.93
7	Trenchers	a	1.54	0.03	NA	0.003	9.14	10.02	1.44	0.20	0.93
7	Bore/Drill Rigs	a	1.41	0.03	NA	0.003	9.20	11.01	1.44	0.20	0.93
7	Excavators	a	0.70	0.01	NA	0.003	5.20	10.75	1.44	0.20	0.93
7	Concrete/Industrial Saws	a	1.41	0.03	NA	0.003	9.20	11.01	1.44	0.20	0.93
7	Cement and Mortar Mixers		1.01	0.02	NA	0.005	4.60	11.01	0.90	0.20	0.93
7	Cranes	a	1.26	0.03	NA	0.003	4.20	10.30	1.44	0.20	0.93
7	Graders	a	1.54	0.03	NA	0.003	3.80	9.60	1.00	0.12	0.87
7	Off-Highway Trucks	a	0.84	0.02	NA	0.003	2.80	9.60	0.80	0.22	0.89
7	Crushing/Proc. Equipment	a	1.41	0.03	NA	0.003	9.20	11.01	1.44	0.20	0.93
7	Rough Terrain Forklifts	a	1.68	0.03	NA	0.003	10.00	8.00	1.60	0.20	0.93
7	Rubber Tired Loaders	a	0.84	0.02	NA	0.003	4.80	10.30	1.29	0.20	0.86
7	Rubber Tired Dozers	a	0.84	0.02	NA	0.003	2.80	9.60	0.66	0.16	0.93
7	Tractors/Loaders/Backhoes	a	1.40	0.03	NA	0.003	6.80	10.10	1.05	0.10	0.85
7	Crawler Tractors	a	1.26	0.03	NA	0.003	4.80	10.30	1.11	0.17	0.85
7	Skid Steer Loaders	a	2.10	0.04	NA	0.003	9.00	9.60	1.44	0.20	0.93
7	Off-Highway Tractors	a	2.46	0.05	NA	0.003	14.08	11.91	2.03	0.28	0.93
7	Dumpers/Tenders	a	0.84	0.02	NA	0.003	2.80	9.60	1.44	0.20	0.89
7	Other Construction Equipment	a	1.41	0.03	NA	0.003	9.20	11.01	1.44	0.20	0.93
8	2-Wheel Tractors		NA	NA	NA	NA	NA	NA	NA	NA	NA
8	Agricultural Tractors	a	2.23	0.04	NA	0.003	8.94	11.21	2.05	0.34	0.87
8	Agricultural Mowers		NA	NA	NA	NA	NA	NA	NA	NA	NA
8	Combines	a	1.26	0.03	NA	0.003	4.20	11.50	2.42	0.30	0.92
8	Sprayers		2.23	0.04	NA	0.003	3.78	7.78	1.51	0.30	0.92
8	Balers		2.23	0.04	NA	0.003	3.78	7.78	1.51	0.30	0.92
8	Tillers > 5 hp		1.20	0.02	NA	0.007	5.00	8.00	1.00	0.06	0.92
8	Swathers		0.90	0.02	NA	0.003	2.10	11.50	1.51	0.30	0.92
8	Hydro Power Units		2.23	0.04	NA	0.003	3.78	7.78	1.51	0.30	0.92
8	Other Agricultural Equipment		1.82	0.04	NA	0.003	4.37	11.12	1.51	0.30	0.92
9	Chain Saws > 4 hp		NA	NA	NA	NA	NA	NA	NA	NA	NA
9	Shredders > 5 hp		NA	NA	NA	NA	NA	NA	NA	NA	NA
9	Skidders	a	0.84	0.02	NA	0.003	5.20	11.30	1.44	0.20	0.93
9	Fellers/Bunchers	a	0.84	0.02	NA	0.003	5.20	11.30	1.44	0.20	0.93

Evap* = g/day
* g/hr
** g/gallon
a = Exhaust HC, CO, and PM adjusted for transient speed and/or transient load operation
NA = Not applicable

Table 2-07. (Continued)

b. GASOLINE 4-STROKE EQUIPMENT (grams/hp-hr) Not Adjusted for In-Use Effects

Class	Equipment Types		HC				CO	NO$_x$	PM	Aldehydes	SO$_x$
			Exhaust	Crank	Evap*	Refueling					
1	Trimmers/Edgers/Brush Cutters		24.18	7.98	0.54	21.98	393.34	2.02	0.41	0.53	0.37
1	Lawnmowers		37.70	12.44	1.16	8.60	430.00	2.02	0.74	0.53	0.37
1	Leaf Blowers/Vacuums		19.40	6.40	0.61	6.61	380.30	2.03	0.29	0.53	0.37
1	Rear Engine Riding Mowers		9.30	3.07	3.30	3.21	353.00	2.03	0.05	0.24	0.37
1	Front Mowers		9.30	3.07	18.60	1.30	353.00	2.03	0.05	0.24	0.37
1	Chain Saws < 4 hp		NA	NA	NA	NA	NA	NA	NA	NA	NA
1	Shredders < 5 hp		37.70	12.44	1.75	7.68	430.00	2.02	0.74	0.53	0.37
1	Tillers < 5 hp		37.70	12.44	1.38	9.39	430.00	2.02	0.74	0.53	0.37
1	Lawn and Garden Tractors		9.40	3.10	7.13	1.84	354.00	2.11	0.10	0.24	0.37
1	Wood Splitters		37.70	12.44	1.16	8.60	430.00	2.02	0.74	0.53	0.37
1	Snowblowers		37.70	12.44	2.50	5.82	430.00	2.02	0.74	0.53	0.37
1	Chippers/Stump Grinders		37.70	12.44	94.86	0.42	430.00	2.02	0.05	0.53	0.37
1	Commercial Turf Equipment		9.40	3.10	15.50	1.38	354.00	2.11	0.10	0.24	0.37
1	Other Lawn and Garden Equipment		37.70	12.44	1.16	8.60	430.00	2.02	0.05	0.53	0.37
2	Aircraft Support Equipment		6.68	2.20	73.44	0.48	199.00	5.16	0.06	0.22	0.27
2	Terminal Tractors		6.68	2.20	17.13	0.52	199.00	5.16	0.06	0.22	0.27
3	All Terrain Vehicles (ATVs)	*	100.00	33.00	6.00	31.15	975.00	9.00	1.15	1.18	0.55
3	Minibikes	*	100.00	33.00	1.50	21.68	975.00	9.00	1.15	1.18	0.55
3	Off-Road Motorcycles	*	100.00	33.00	6.00	30.92	975.00	9.00	1.15	1.18	0.55
3	Golf Carts	*	100.00	33.00	18.00	5.44	975.00	9.00	1.15	1.18	0.55
3	Snowmobiles		NA	NA	NA	NA	NA	NA	NA	NA	NA
3	Specialty Vehicles Carts	*	100.00	33.00	18.00	7.04	975.00	9.00	1.15	1.18	0.55
4	Vessels w/Inboard Engines	**	72.46	NA	260.10	5.13	1214.03	45.79	0.74	3.07	2.90
4	Vessels w/Outboard Engines	**	87.71	28.94	NA	8.75	1421.95	66.58	0.74	3.07	2.90
4	Vessels w/Sterndrive Engines	**	72.46	NA	63.00	5.26	1214.03	45.79	0.74	3.07	2.90
4	Sailboat Auxiliary Inboard Engines	**	72.46	NA	18.00	8.75	1214.03	45.79	0.74	3.07	2.90
4	Sailboat Auxiliary Outboard Engines	**	87.71	28.94	NA	8.75	1421.95	66.58	0.74	3.07	2.90
5	Generator Sets < 50 hp		9.50	3.14	3.06	3.43	353.00	2.03	0.06	0.22	0.27
5	Pumps < 50 hp		9.50	3.14	2.25	6.33	353.00	2.03	0.06	0.22	0.27
5	Air Compressors < 50 hp		9.50	3.14	3.38	3.20	353.00	2.03	0.06	0.22	0.27
5	Gas Compressors < 50 hp		NA	NA	NA	NA	NA	NA	NA	NA	NA
5	Welders < 50 hp		9.50	3.14	9.75	1.72	353.00	2.03	0.06	0.22	0.27
5	Pressure Washers < 50 hp		9.50	3.14	2.25	6.33	353.00	2.03	0.06	0.22	0.27
6	Aerial Lifts		6.68	2.20	55.08	0.49	199.00	5.16	0.06	0.22	0.27
6	Forklifts		6.68	2.20	54.00	0.49	199.00	5.16	0.06	0.22	0.27
6	Sweepers/Scrubbers		6.68	2.20	59.67	0.48	199.00	5.16	0.06	0.22	0.27
6	Other General Industrial Equipment		6.68	2.20	29.07	0.93	199.00	5.16	0.06	0.22	0.27
6	Other Material Handling Equipment		6.68	2.20	78.03	0.48	199.00	5.16	0.06	0.22	0.27
7	Asphalt Pavers		6.49	2.14	47.43	0.45	198.00	4.79	0.06	0.22	0.25
7	Tampers/Rammers		6.49	2.14	2.81	5.34	198.00	4.79	0.06	0.22	0.25
7	Plate Compactors		6.49	2.14	[illegible]	5.34	198.00	4.79	0.06	0.22	0.25
7	Concrete Pavers		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Rollers		9.25	3.05	9.00	1.61	202.00	5.28	0.06	0.26	0.28

Table 2-07b. (Continued)

Class	Equipment Types		HC				CO	NO$_x$	PM	Aldehydes	SO$_x$
			Exhaust	Crank	Evap*	Refueling					
7	Scrapers		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Paving Equipment		6.49	2.14	3.00	5.02	198.00	4.79	0.06	0.22	0.25
7	Surfacing Equipment		6.49	2.14	3.00	4.84	198.00	4.79	0.06	0.22	0.25
7	Signal Boards		6.49	2.14	3.06	4.94	198.00	4.79	0.06	0.22	0.25
7	Trenchers		6.49	2.14	7.89	0.94	198.00	4.79	0.06	0.22	0.25
7	Bore/Drill Rigs		6.49	2.14	82.62	0.42	198.00	4.79	0.06	0.22	0.25
7	Excavators		6.49	2.14	122.40	0.42	198.00	4.79	0.06	0.22	0.25
7	Concrete/Industrial Saws		6.49	2.14	4.13	2.74	198.00	4.79	0.06	0.22	0.25
7	Cement and Mortar Mixers		6.49	2.14	3.75	4.09	198.00	4.79	0.06	0.22	0.25
7	Cranes		6.49	2.14	84.15	0.42	198.00	4.79	0.06	0.22	0.25
7	Graders		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Off-Highway Trucks		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Crushing/Proc. Equipment		6.49	2.14	91.80	0.42	198.00	4.79	0.06	0.22	0.25
7	Rough Terrain Forklifts		6.49	2.14	134.64	0.42	198.00	4.79	0.06	0.22	0.25
7	Rubber Tired Loaders		5.56	1.83	102.51	0.42	163.00	5.42	0.06	0.22	0.24
7	Rubber Tired Dozers		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Tractors/Loaders/Backhoes		6.49	2.14	96.39	0.42	198.00	4.79	0.06	0.22	0.25
7	Crawler Tractors		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Skid Steer Loaders		6.49	2.14	25.01	0.44	198.00	4.79	0.06	0.22	0.25
7	Off-Highway Tractors		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Dumpers/Tenders		6.49	2.14	9.00	1.74	198.00	4.79	0.06	0.22	0.25
7	Other Construction Equipment		6.49	2.14	229.50	0.41	198.00	4.79	0.06	0.22	0.25
8	2-Wheel Tractors		5.49	1.81	7.13	2.69	143.00	6.62	0.06	0.30	0.23
8	Agricultural Tractors		5.49	1.81	133.11	0.42	143.00	6.62	0.06	0.30	0.23
8	Agricultural Mowers		7.18	2.37	8.01	1.84	218.00	5.24	0.06	0.22	0.28
8	Combines		7.18	2.37	200.43	0.41	218.00	5.24	0.06	0.22	0.28
8	Sprayers		7.18	2.37	4.50	1.39	218.00	5.24	0.06	0.22	0.28
8	Balers		NA	NA	NA	NA	NA	NA	NA	NA	NA
8	Tillers > 5 hp		37.70	12.44	3.63	4.38	430.00	2.02	0.74	0.22	0.37
8	Swathers		7.18	2.37	162.18	0.42	218.00	5.24	0.06	0.22	0.28
8	Hydro Power Units		7.18	2.37	15.00	1.40	218.00	5.24	0.06	0.22	0.28
8	Other Agricultural Equipment		7.18	2.37	84.15	0.42	218.00	5.24	0.06	0.22	0.28
9	Chain Saws > 4 hp		NA	NA	NA	NA	NA	NA	NA	NA	NA
9	Shredders > 5 hp		9.30	3.07	3.00	5.02	353.00	2.02	0.05	0.24	0.37
9	Skidders		NA	NA	NA	NA	NA	NA	NA	NA	NA
9	Fellers/Bunchers		NA	NA	NA	NA	NA	NA	NA	NA	NA

Evap* = g/day
* g/hr
** g/gallon
NA = Not applicable

Table 2-07. (Continued)

c. GASOLINE 4-STROKE EQUIPMENT - (grams/hp-hr) Adjusted for In-Use Effects

Class	Equipment Types		HC				CO	NO_x	PM	Aldehydes	SO_x
			Exhaust	Crank	Evap*	Refueling					
1	Trimmers/Edgers/Brush Cutters	b	50.78	7.98	0.54	21.98	747.35	0.81	1.48	0.53	0.37
1	Lawnmowers	b	79.17	12.44	1.16	8.60	817.00	0.81	2.66	0.53	0.37
1	Leaf Blowers/Vacuums	b	40.74	6.40	0.61	6.61	722.57	0.81	1.04	0.53	0.37
1	Rear Engine Riding Mowers	b	19.53	3.07	3.30	3.21	670.70	0.81	0.18	0.24	0.37
1	Front Mowers	b	19.53	3.07	18.60	1.30	670.70	0.81	0.18	0.24	0.37
1	Chain Saws < 4 hp		NA	NA	NA	NA	NA	NA	NA	NA	NA
1	Shredders < 5 hp	b	79.17	12.44	1.75	7.68	817.00	0.81	2.66	0.53	0.37
1	Tillers < 5 hp	b	79.17	12.44	1.38	9.39	817.00	0.81	2.66	0.53	0.37
1	Lawn and Garden Tractors	b	19.74	3.10	7.13	1.84	672.60	0.84	0.36	0.24	0.37
1	Wood Splitters	b	79.17	12.44	1.16	8.60	817.00	0.81	2.66	0.53	0.37
1	Snowblowers	b	79.17	12.44	2.50	5.82	817.00	0.81	2.66	0.53	0.37
1	Chippers/Stump Grinders	c	56.55	12.44	94.86	0.42	559.00	2.02	0.05	0.53	0.37
1	Commercial Turf Equipment	b	19.74	3.10	15.50	1.38	672.60	0.84	0.36	0.24	0.37
1	Other Lawn and Garden Equipment	b	79.17	12.44	1.16	8.60	817.00	0.81	0.18	0.53	0.37
2	Aircraft Support Equipment	c	10.02	2.20	73.44	0.48	258.70	5.16	0.06	0.22	0.27
2	Terminal Tractors	c	10.02	2.20	17.13	0.52	258.70	5.16	0.06	0.22	0.27
3	All Terrain Vehicles (ATVs)	*, b	210.00	33.00	6.00	31.15	1852.50	3.60	4.14	1.18	0.55
3	Minibikes	*, b	210.00	33.00	1.50	21.68	1852.50	3.60	4.14	1.18	0.55
3	Off-Road Motorcycles	*, c	150.00	33.00	6.00	30.92	1267.50	9.00	1.15	1.18	0.55
3	Golf Carts	*, b	210.00	33.00	18.00	5.44	1852.50	3.60	4.14	1.18	0.55
3	Snowmobiles		NA	NA	NA	NA	NA	NA	NA	NA	NA
3	Specialty Vehicles Carts	*, b	210.00	33.00	18.00	7.04	1852.50	3.60	4.14	1.18	0.55
4	Vessels w/Inboard Engines	**, c	108.69	NA	260.10	5.13	1578.24	45.79	0.74	3.07	2.90
4	Vessels w/Outboard Engines	**, c	131.57	28.94	NA	8.75	1848.54	66.58	0.74	3.07	2.90
4	Vessels w/Sterndrive Engines	**, c	108.69	NA	63.00	5.26	1578.24	45.79	0.74	3.07	2.90
4	Sailboat Auxiliary Inboard Engines	**, c	108.69	NA	18.00	8.75	1578.24	45.79	0.74	3.07	2.90
4	Sailboat Auxiliary Outboard Engines	**, c	131.57	28.94	NA	8.75	1848.54	66.58	0.74	3.07	2.90
5	Generator Sets < 50 hp	b	19.95	3.14	3.06	3.43	670.70	0.81	0.22	0.22	0.27
5	Pumps < 50 hp	b	19.95	3.14	2.25	6.33	670.70	0.81	0.22	0.22	0.27
5	Air Compressors < 50 hp	b	19.95	3.14	3.38	3.20	670.70	0.81	0.22	0.22	0.27
5	Gas Compressors < 50 hp	c	NA	NA	NA	NA	NA	NA	NA	NA	NA
5	Welders < 50 hp	b	19.95	3.14	9.75	1.72	670.70	0.81	0.22	0.22	0.27
5	Pressure Washers < 50 hp	b	19.95	3.14	2.25	6.33	670.70	0.81	0.22	0.22	0.27
6	Aerial Lifts	c	10.02	2.20	55.08	0.49	258.70	5.16	0.06	0.22	0.27
6	Forklifts	c	10.02	2.20	54.00	0.49	258.70	5.16	0.06	0.22	0.27
6	Sweepers/Scrubbers	c	10.02	2.20	59.67	0.48	258.70	5.16	0.06	0.22	0.27
6	Other General Industrial Equipment	c	10.02	2.20	29.07	0.93	258.70	5.16	0.06	0.22	0.27
6	Other Material Handling Equipment	c	10.02	2.20	78.03	0.48	258.70	5.16	0.06	0.22	0.27
7	Asphalt Pavers	c	9.74	2.14	47.43	0.45	257.40	4.79	0.06	0.22	0.25
7	Tampers/Rammers	b	13.63	2.14	2.81	5.34	376.20	1.92	0.22	0.22	0.25
7	Plate Compactors	b	13.63	2.14	2.81	5.34	376.20	1.92	0.22	0.22	0.25
7	Concrete Pavers		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Rollers	b	19.43	3.05	9.00	1.61	383.80	2.11	0.22	0.26	0.28

Table 2-07c. (Continued)

Class	Equipment Types		HC				CO	NO$_x$	PM	Aldehydes	SO$_x$
			Exhaust	Crank	Evap*	Refueling					
7	Scrapers		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Paving Equipment	b	13.63	2.14	3.00	5.02	376.20	1.92	0.22	0.22	0.25
7	Surfacing Equipment	b	13.63	2.14	3.00	4.84	376.20	1.92	0.22	0.22	0.25
7	Signal Boards	b	13.63	2.14	3.06	4.94	376.20	1.92	0.22	0.22	0.25
7	Trenchers	c	9.74	2.14	7.69	0.94	257.40	4.79	0.06	0.22	0.25
7	Bore/Drill Rigs	c	9.74	2.14	82.62	0.42	257.40	4.79	0.06	0.22	0.25
7	Excavators	c	9.74	2.14	122.40	0.42	257.40	4.79	0.06	0.22	0.25
7	Concrete/Industrial Saws	b	13.63	2.14	4.13	2.74	376.20	1.92	0.22	0.22	0.25
7	Cement and Mortar Mixers	b	13.63	2.14	3.75	4.09	376.20	1.92	0.22	0.22	0.25
7	Cranes	c	9.74	2.14	84.15	0.42	257.40	4.79	0.06	0.22	0.25
7	Graders		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Off-Highway Trucks		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Crushing/Proc. Equipment	c	9.74	2.14	91.80	0.42	257.40	4.79	0.06	0.22	0.25
7	Rough Terrain Forklifts	c	9.74	2.14	134.64	0.42	257.40	4.79	0.06	0.22	0.25
7	Rubber Tired Loaders	c	8.34	1.83	102.51	0.42	211.90	5.42	0.06	0.22	0.24
7	Rubber Tired Dozers		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Tractors/Loaders/Backhoes	c	9.74	2.14	96.39	0.42	257.40	4.79	0.06	0.22	0.25
7	Crawler Tractors		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Skid Steer Loaders	c	9.74	2.14	25.01	0.44	257.40	4.79	0.06	0.22	0.25
7	Off-Highway Tractors		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Dampers/Tenders	b	13.63	2.14	9.00	1.74	376.20	1.92	0.22	0.22	0.25
7	Other Construction Equipment	c	9.74	2.14	229.50	0.41	257.40	4.79	0.06	0.22	0.25
8	2-Wheel Tractors	b	11.53	1.81	7.13	2.69	271.70	2.65	0.22	0.30	0.23
8	Agricultural Tractors	c	8.24	1.81	133.11	0.42	185.90	6.62	0.06	0.30	0.23
8	Agricultural Mowers	b	15.08	2.37	8.01	1.84	414.20	2.10	0.22	0.22	0.28
8	Combines	c	10.77	2.37	200.43	0.41	283.40	5.24	0.06	0.22	0.28
8	Sprayers	c	10.77	2.37	4.50	1.39	283.40	5.24	0.06	0.22	0.28
8	Balers		NA	NA	NA	NA	NA	NA	NA	NA	NA
8	Tillers > 5 hp	b	79.17	12.44	3.63	4.38	817.00	0.81	2.66	0.22	0.37
8	Swathers	c	10.77	2.37	162.18	0.42	283.40	5.24	0.06	0.22	0.28
8	Hydro Power Units	b	15.08	2.37	15.00	1.40	414.20	2.10	0.22	0.22	0.28
8	Other Agricultural Equipment	c	10.77	2.37	84.15	0.42	283.40	5.24	0.06	0.22	0.28
9	Chain Saws > 4 hp		NA	NA	NA	NA	NA	NA	NA	NA	NA
9	Shredders > 5 hp	b	19.53	3.07	3.00	5.02	670.70	0.81	0.18	0.24	0.37
9	Skidders		NA	NA	NA	NA	NA	NA	NA	NA	NA
9	Fellers/Bunchers		NA	NA	NA	NA	NA	NA	NA	NA	NA

Evap* = g/day
* g/hr
** g/gallon
b = adjusted for in-use effects using small utility engine data
c = adjusted for in-use effects using heavy duty engine data
NA = Not applicable

Table 2-07. (Continued)

d. GASOLINE 2-STROKE EQUIPMENT (grams/hp-hr) Not Adjusted for In-Use Effects

Class	Equipment Types		HC				CO	NO_x	PM	Aldehydes	SO_x
			Exhaust	Crank	Evap*	Refueling					
1	Trimmers/Edgers/Brush Cutters		224.56	NA	0.54	21.98	728.22	0.91	3.89	2.04	0.54
1	Lawnmowers		208.00	NA	1.16	8.60	486.00	0.29	7.70	2.04	0.54
1	Leaf Blowers/Vacuums		215.29	NA	0.61	6.61	716.81	0.96	3.60	2.04	0.54
1	Rear Engine Riding Mowers		NA	NA	NA	NA	NA	NA	NA	NA	NA
1	Front Mowers		NA	NA	NA	NA	NA	NA	NA	NA	NA
1	Chain Saws < 4 hp		298.00	NA	0.32	35.93	699.00	0.96	3.60	1.60	0.54
1	Shredders < 5 hp		208.00	NA	1.75	7.68	486.00	0.29	7.70	2.04	0.54
1	Tillers < 5 hp		208.00	NA	1.38	9.39	486.00	0.29	7.70	2.04	0.54
1	Lawn and Garden Tractors		NA	NA	NA	NA	NA	NA	NA	NA	NA
1	Wood Splitters		NA	NA	NA	NA	NA	NA	NA	NA	NA
1	Snowblowers		208.00	NA	2.50	5.82	486.00	0.29	7.70	2.04	0.54
1	Chippers/Stump Grinders		NA	NA	NA	NA	NA	NA	NA	NA	NA
1	Commercial Turf Equipment		208.00	NA	15.50	1.38	486.00	0.29	7.70	2.04	0.54
1	Other Lawn and Garden Equipment		208.00	NA	1.16	8.60	486.00	0.29	7.70	2.04	0.54
2	Aircraft Support Equipment		NA	NA	NA	NA	NA	NA	NA	NA	NA
2	Terminal Tractors	**	3.00	0.99	17.13	0.52	63.70	17.90	0.05	0.22	0.00
3	All Terrain Vehicles (ATVs)	*	600.00	NA	6.00	31.15	800.00	1.50	8.20	2.75	0.95
3	Minibikes	*	NA	NA	NA	21.68	NA	NA	NA	NA	NA
3	Off-Road Motorcycles	*	600.00	NA	6.00	30.92	800.00	1.50	8.20	2.75	0.95
3	Golf Carts	*	600.00	NA	18.00	5.44	800.00	1.50	8.20	2.75	0.95
3	Snowmobiles		109.00	NA	24.24	0.67	169.00	1.70	4.80	0.40	0.15
3	Specialty Vehicles Carts	*	600.00	NA	18.00	7.04	800.00	1.50	8.20	2.75	0.95
4	Vessels w/Inboard Engines	***	728.06	NA	260.10	5.13	1357.34	8.77	48.10	3.07	2.90
4	Vessels w/Outboard Engines	***	728.06	NA	NA	8.75	1357.34	8.77	48.10	3.07	2.90
4	Vessels w/Sterndrive Engines	***	728.06	NA	63.00	5.26	1357.34	8.77	48.10	3.07	2.90
4	Sailboat Auxiliary Inboard Engines	***	NA	NA	NA	NA	NA	NA	NA	NA	NA
4	Sailboat Auxiliary Outboard Engines	***	728.06	NA	NA	8.75	1357.34	8.77	48.10	3.07	2.90
5	Generator Sets < 50 hp		208.00	NA	3.06	3.43	486.00	0.29	7.70	2.04	0.27
5	Pumps < 50 hp	**	4.28	1.41	2.25	6.33	113.00	7.04	0.05	0.22	0.00
5	Air Compressors < 50 hp		NA	NA	NA	NA	NA	NA	NA	NA	NA
5	Gas Compressors < 50 hp	**	4.28	1.41	NA	NA	113.00	7.04	0.05	0.22	0.00
5	Welders < 50 hp		NA	NA	NA	NA	NA	NA	NA	NA	NA
5	Pressure Washers < 50 hp		NA	NA	NA	NA	NA	NA	NA	NA	NA
6	Aerial Lifts	**	3.00	0.99	55.08	0.49	63.70	17.90	0.05	0.22	0.00
6	Forklifts	**	3.00	0.99	54.00	0.49	63.70	17.90	0.05	0.22	0.00
6	Sweepers/Scrubbers	**	3.00	0.99	59.67	0.48	63.70	17.90	0.05	0.22	0.00
6	Other General Industrial Equipment		208.00	NA	29.07	0.93	486.00	0.29	7.70	2.04	0.27
6	Other Material Handling Equipment		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Asphalt Pavers		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Tampers/Rammers		208.00	NA	2.81	5.34	486.00	0.29	7.70	2.04	0.25
7	Plate Compactors		208.00	NA	2.81	5.34	486.00	0.29	7.70	2.04	0.25
7	Concrete Pavers		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Rollers		NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 2-07d. (Continued)

Class	Equipment Types		HC				CO	NO_x	PM	Aldehydes	SO_x
			Exhaust	Crank	Evap*	Refueling					
7	Scrapers		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Paving Equipment		208.00	NA	3.00	5.02	486.00	0.29	7.70	2.04	0.25
7	Surfacing Equipment		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Signal Boards		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Trenchers		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Bore/Drill Rigs		208.00	NA	82.62	0.42	486.00	0.29	7.70	2.04	0.25
7	Excavators		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Concrete/Industrial Saws		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Cement and Mortar Mixers		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Cranes		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Graders		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Off-Highway Trucks		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Crushing/Proc. Equipment		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Rough Terrain Forklifts		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Rubber Tired Loaders		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Rubber Tired Dozers		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Tractors/Loaders/Backhoes		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Crawler Tractors		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Skid Steer Loaders		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Off-Highway Tractors		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Dumpers/Tenders		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Other Construction Equipment		NA	NA	NA	NA	NA	NA	NA	NA	NA
8	2-Wheel Tractors		NA	NA	NA	NA	NA	NA	NA	NA	NA
8	Agricultural Tractors		NA	NA	NA	NA	NA	NA	NA	NA	NA
8	Agricultural Mowers		NA	NA	NA	NA	NA	NA	NA	NA	NA
8	Combines		NA	NA	NA	NA	NA	NA	NA	NA	NA
8	Sprayers		NA	NA	NA	NA	NA	NA	NA	NA	NA
8	Balers		NA	NA	NA	NA	NA	NA	NA	NA	NA
8	Tillers > 5 hp		NA	NA	NA	NA	NA	NA	NA	NA	NA
8	Swathers		NA	NA	NA	NA	NA	NA	NA	NA	NA
8	Hydro Power Units		NA	NA	NA	NA	NA	NA	NA	NA	NA
8	Other Agricultural Equipment		NA	NA	NA	NA	NA	NA	NA	NA	NA
9	Chain Saws > 4 hp		152.00	NA	0.66	18.22	513.00	0.96	3.60	1.60	0.37
9	Shredders > 5 hp		NA	NA	NA	NA	NA	NA	NA	NA	NA
9	Skidders		NA	NA	NA	NA	NA	NA	NA	NA	NA
9	Fellers/Bunchers		NA	NA	NA	NA	NA	NA	NA	NA	NA

Evap* = g/day
* g/hr
** Emission factors for 4-stroke propane-fueled equipment
*** g/gallon
NA = Not applicable

Table 2-07. (Continued)

e. GASOLINE 2-STROKE EQUIPMENT - (grams/hp-hr) Adjusted for In-Use Effects

Class	Equipment Types		HC				CO	NO_x	PM	Aldehydes	SO_x
			Exhaust	Crank	Evap^a	Refueling					
1	Trimmers/Edgers/Brush Cutters	d	471.58	NA	0.54	21.98	1383.62	0.91	3.89	2.04	0.54
1	Lawnmowers	d	436.80	NA	1.16	8.60	923.40	0.29	7.70	2.04	0.54
1	Leaf Blowers/Vacuums	d	452.11	NA	0.61	6.61	1361.94	0.96	3.60	2.04	0.54
1	Rear Engine Riding Mowers		NA	NA	NA	NA	NA	NA	NA	NA	NA
1	Front Mowers		NA	NA	NA	NA	NA	NA	NA	NA	NA
1	Chain Saws < 4 hp	d	625.80	NA	0.32	35.93	1328.10	0.96	3.60	1.60	0.54
1	Shredders < 5 hp	d	436.80	NA	1.75	7.68	923.40	0.29	7.70	2.04	0.54
1	Tillers < 5 hp	d	436.80	NA	1.38	9.39	923.40	0.29	7.70	2.04	0.54
1	Lawn and Garden Tractors		NA	NA	NA	NA	NA	NA	NA	NA	NA
1	Wood Splitters		NA	NA	NA	NA	NA	NA	NA	NA	NA
1	Snowblowers	d	436.80	NA	2.50	5.82	923.40	0.29	7.70	2.04	0.54
1	Chippers/Stump Grinders		NA	NA	NA	NA	NA	NA	NA	NA	NA
1	Commercial Turf Equipment	d	436.80	NA	15.50	1.38	923.40	0.29	7.70	2.04	0.54
1	Other Lawn and Garden Equipment	d	436.80	NA	1.16	8.60	923.40	0.29	7.70	2.04	0.54
2	Aircraft Support Equipment		NA	NA	NA	NA	NA	NA	NA	NA	NA
2	Terminal Tractors	**, c	4.50	0.99	17.13	0.52	82.81	17.90	0.05	0.22	0.00
3	All Terrain Vehicles (ATVs)	*, d	1260.00	NA	6.00	31.15	1520.00	1.50	8.20	2.75	0.95
3	Minibikes		NA	NA	NA	NA	NA	NA	NA	NA	NA
3	Off-Road Motorcycles	*, d	1260.00	NA	6.00	30.92	1520.00	1.50	8.20	2.75	0.95
3	Golf Carts	*, d	1260.00	NA	18.00	5.44	1520.00	1.50	8.20	2.75	0.95
3	Snowmobiles	d	228.90	NA	24.24	0.67	321.10	1.70	4.80	0.40	0.15
3	Specialty Vehicles Carts	*, d	1260.00	NA	18.00	7.04	1520.00	1.50	8.20	2.75	0.95
4	Vessels w/Inboard Engines	***, e	873.67	NA	260.10	5.13	1628.81	8.77	48.10	3.07	2.90
4	Vessels w/Outboard Engines	***, c	873.67	NA	NA	8.75	1628.81	8.77	48.10	3.07	2.90
4	Vessels w/Sterndrive Engines	***, c	873.67	NA	63.00	5.26	1628.81	8.77	48.10	3.07	2.90
4	Sailboat Auxiliary Inboard Engines		NA	NA	NA	NA	NA	NA	NA	NA	NA
4	Sailboat Auxiliary Outboard Engines	***, e	873.67	NA	NA	8.75	1628.81	8.77	48.10	3.07	2.90
5	Generator Sets < 50 hp	d	436.80	NA	3.06	3.43	923.40	0.29	7.70	2.04	0.27
5	Pumps < 50 hp	**, b	8.99	1.41	2.25	6.33	214.70	2.82	0.18	0.22	0.00
5	Air Compressors < 50 hp		NA	NA	NA	NA	NA	NA	NA	NA	NA
5	Gas Compressors < 50 hp	**, c	6.42	1.41	NA	NA	146.90	7.04	0.05	0.22	0.00
5	Welders < 50 hp		NA	NA	NA	NA	NA	NA	NA	NA	NA
5	Pressure Washers < 50 hp		NA	NA	NA	NA	NA	NA	NA	NA	NA
6	Aerial Lifts	**, c	4.50	1.49	55.08	0.49	82.81	17.90	0.05	0.22	0.00
6	Forklifts	**, c	4.50	1.49	54.00	0.49	82.81	17.90	0.05	0.22	0.00
6	Sweepers/Scrubbers	**, c	4.50	1.49	59.67	0.48	82.81	17.90	0.05	0.22	0.00
6	Other General Industrial Equipment	c	312.00	NA	29.07	0.93	631.80	0.29	7.70	2.04	0.27
6	Other Material Handling Equipment		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Asphalt Pavers		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Tampers/Rammers	d	436.80	NA	2.81	5.34	923.40	0.29	7.70	2.04	0.25
7	Plate Compactors	d	436.80	NA	2.81	5.34	923.40	0.29	7.70	2.04	0.25
7	Concrete Pavers		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Rollers		NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 2-07e. (Continued)

Class	Equipment Types		HC				CO	NO_x	PM	Aldehydes	SO_x
			Exhaust	Crank	Evap*	Refueling					
7	Scrapers		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Paving Equipment	d	436.80	NA	3.00	5.02	923.40	0.29	7.70	2.04	0.25
7	Surfacing Equipment		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Signal Boards		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Trenchers		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Bore/Drill Rigs	d	436.80	NA	82.62	0.42	923.40	0.29	7.70	2.04	0.25
7	Excavators		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Concrete/Industrial Saws		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Cement and Mortar Mixers		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Cranes		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Graders		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Off-Highway Trucks		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Crushing/Proc. Equipment		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Rough Terrain Forklifts		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Rubber Tired Loaders		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Rubber Tired Dozers		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Tractors/Loaders/Backhoes		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Crawler Tractors		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Skid Steer Loaders		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Off-Highway Tractors		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Dumpers/Tenders		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Other Construction Equipment		NA	NA	NA	NA	NA	NA	NA	NA	NA
8	2-Wheel Tractors		NA	NA	NA	NA	NA	NA	NA	NA	NA
8	Agricultural Tractors		NA	NA	NA	NA	NA	NA	NA	NA	NA
8	Agricultural Mowers		NA	NA	NA	NA	NA	NA	NA	NA	NA
8	Combines		NA	NA	NA	NA	NA	NA	NA	NA	NA
8	Sprayers		NA	NA	NA	NA	NA	NA	NA	NA	NA
8	Balers		NA	NA	NA	NA	NA	NA	NA	NA	NA
8	Tillers > 5 hp		NA	NA	NA	NA	NA	NA	NA	NA	NA
8	Swathers		NA	NA	NA	NA	NA	NA	NA	NA	NA
8	Hydro Power Units		NA	NA	NA	NA	NA	NA	NA	NA	NA
8	Other Agricultural Equipment		NA	NA	NA	NA	NA	NA	NA	NA	NA
9	Chain Saws > 4 hp	d	319.20	NA	0.66	18.22	974.70	0.96	12.96	.60	0.37
9	Shredders > 5 hp		NA	NA	NA	NA	NA	NA	NA	NA	NA
9	Skidders		NA	NA	NA	NA	NA	NA	NA	NA	NA
9	Fellers/Bunchers		NA	NA	NA	NA	NA	NA	NA	NA	NA

Evap* = g/day
* g/hr
** Emission factors for 4-stroke propane-fueled equipment
*** g/gallon
b = adjusted for in-use effects using small utility engine data
c = adjusted for in-use effects using heavy duty engine data
d = adjusted for in-use effects using small utility engine data except no NO_x or PM adjustment
e = adjusted for in-use effects by a factor of 1.2 for HC and CO
NA = Not Applicable

Key:

1 = Lawn and Garden
2 = Airport Service
3 = Recreational Equipment
4 = Recreational Marine
5 = Light Commercial
6 = Industrial
7 = Construction
8 = Agricultural
9 = Logging

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Table 2-08a. Summer and Winter Percentages of Yearly Activity.

Equipment Class	Cold/Northern		Medium/Central		Warm/Southern	
	Summer (%)	Winter (%)	Summer (%)	Winter (%)	Summer (%)	Winter (%)
Agricultural	50	6	40	6	34	6
Construction	43	10	38	15	33	20
Industrial	30	20	25	25	25	25
Lawn and Garden (excl. chain saws)	50	6	40	6	34	6
Snowblowers/Snowmobiles	0	100	0	100	0	100
Commercial Marine	25	25	25	25	25	25
Airport Service	25	25	25	25	25	25
Logging (including chain saws)	25	25	25	25	25	25
Light Commercial	25	25	25	25	25	25

Table 2-08b. Summer and Winter Percentages of Yearly Activity for Recreational Marine Equipment

Region	% During Summer	% During Winter
Northeast	68	1
Southeast	48	7
Mid-Atlantic Coast	57	2
Great Lakes	70	0
Southwest	48	7
Rocky Mountains	69	0
Northwest	57	5
West Coast	48	7

Table 2-08c. Summer and Winter Percentages of Yearly Activity for Recreational Equipment.[‡‡‡‡‡‡]

Region	% During Summer	% During Winter
East	42%	12%
Midwest	46%	8%
South	36%	15%
West	44%	11%
New England	44%	14%
Mid-Atlantic Coast	41%	12%
East Central	48%	9%
West Central	44%	8%
Southeast	35%	17%
Southwest	37%	12%
Rocky Mountains	44%	8%
Pacific	43%	13%
National Average	42%	12%

[‡‡‡‡‡‡] Excluding snowmobiles.

2.8. Emissions from Commercial Marine Vessels

A detailed analysis of commercial marine vessel activity and emissions was developed for the following nonattainment areas:[‡‡‡‡‡‡]

1. Baltimore, MD MSA
2. Baton Rouge, LA MSA
3. Houston-Galveston-Brazoria, TX CMSA
4. New York-Northern New Jersey-Long Island, NY-NJ-CT CMSA/NECMA
5. Philadelphia-Wilmington-Trenton, PA-NJ-DE-MD CMSA
6. Seattle-Tacoma, WA CMSA

For other nonattainment areas, estimates of emissions from commercial vessels were based on information obtained from different sources, including SIP emission inventories and the 1985 National Emission Report.[7]

When the latter was used, marine vessel activity was assumed to be uniform during the year. Emissions from commercial marine vessels are shown in Table 2-09.

[‡‡‡‡‡‡] This analysis is documented in the Booz•Allen & Hamilton final report entitled "Commercial Marine Vessel Contributions to Emission Inventories," which may also be found in the public docket.

Table 2-09. Emissions from Commercial Marine Vessels

Commercial Vessel Emissions

Geographical Area	tpy VOC	tpy NOx	tpy CO	tpy PM	tpy Aldehydes	tpy SOx	tpsd VOC	tpsd NOx	tpsd CO	Data Sources VOC	Data Sources NOx	Data Sources CO	Data Sources PM/SOx
Baltimore CMSA	1,623	5,970	30,332	302	ND	1,718.54	4.46	16.38	83.10	5	5	5	5
Chicago CMSA	ND	608	ND	300	ND	ND	1.16	26.47	ND	1	1		1
Denver CMSA	ND	ND	0	ND	ND	ND	ND	ND	0.00			1	
Houston CMSA	688	12,462	1,718	741	ND	5,182.10	1.88	34.14	4.71	5	5	5	5
Milwaukee CMSA	457	398	ND	ND	ND	ND	1.25	1.09	ND	3	3		
Boston NECMA	ND	ND	ND	173	ND	ND	0.25	4.96	0.61	1	1	1	1
Hartford NECMA	11	260	29	ND	ND	ND	0.03	0.71	0.08	1	1	1	
New York CMSA/NECMA	789	12,891	2,498	620	ND	4,230.50	2.18	36.50	6.73	5	5	5	5
Philadel. CMSA	484	9,181	1,377	553	ND	4,366.38	1.35	25.15	3.77	5	5	5	5
Seat.-Tac. CMSA	2,194	17,253	31,940	1,017	ND	7,578.74	6.01	47.27	87.51	5	5	5	5
Atlanta CMSA	0	0	ND	ND	ND	ND	0.00	0.00	ND	1	1		
Baton Rouge CMSA	108	1,848	384	108	ND	738.40	0.30	5.07	1.08	5	5	5	5
Cleveland CMSA	1,003	109	3,787	ND	ND	ND	2.75	0.30	ND	3	3		
El Paso CMSA	0	0	0	0	0	0	0.00	0.00	0.00	3	3	3	3
San Jq. Val. AB	ND	ND	ND	82	ND	401.50	0.22	2.64	0.35	1	1	1	1
South Coast AB	ND	ND	ND	1,515	ND	12,796.90	7.30	68.38	10.48	1	1	1	1
Miami CMSA	943	1,310	ND	ND	ND	ND	2.58	3.50	ND	3	3		
Min.-St.Paul CMSA	ND	ND	28	8	ND	ND	ND	ND	0.08			1	1
Provo-Orem CMSA	ND	ND	315	ND	ND	ND	ND	ND	0.86			3	
San Diego AB	ND	ND	ND	854	ND	6,978.80	2.50	41.11	6.75	1	1	1	1
Spokane CMSA	ND	ND	246	ND	ND	ND	ND	ND	0.67			3	
St. Louis CMSA	2,488	1,820	ND	184	ND	ND	6.82	4.98	ND	3	3		
Washington DC CMSA	806	227	2,820	ND	ND	ND	2.21	0.62	7.73	3	3	3	
Springfield NECMA	0	0	0	0	0	0	0.00	0.00	ND	1	1		
Nation	543,464	218,799	1,822,827	16,204	ND	24,603.71	1,488.94	598.45	4,980.22	6	6	6	6

ND - No Data

1. State Implementation Plan / CARB Contractor Study
2. Phase II Volatility Control Support Runs
3. 1985 National Emission Report
4. Cold Carbon Monoxide Support Runs
5. Booz Allen, Hamilton Study for EPA
6. 1989 National Air Pollutant Emission Estimates

2.9. Emissions from Other Sources

EPA compared its estimates of emissions from nonroad engines and vehicles to emissions from highway and other area and point sources. At the national level, 1989 emissions were obtained from the *National Air Pollutant Emission Estimates: 1940-1989*.[8] For all but five nonattainment areas,[ffffff] emissions from highway and other sources were available from the following sources:

VOC: *Phase II Volatility Control Support Runs*, April 5, 1990 - VOC emissions were reported in tons per summer day for 1990.

CO: Support computer runs for Cold CO Rulemaking documentation, Jan. 18, 1991 - CO emissions were reported in tpy for 1987. To estimate tons per winter day, highway vehicle CO emissions were divided by 365 and corrected for decreased driving during the winter. Emissions from other area and point sources were simply divided by 365.

NO_x: *1985 National Emission Report*[9] - NO_x emissions were reported in tons per year for 1985. To estimate tons per summer day, highway vehicle NO_x emissions were divided by 365 and corrected for increased summer driving. Emissions from other area and part sources were simply divided by 365.

PM: *1985 National Emission Report* - PM emissions were reported in tons per year for 1985.

SO_x: *1985 National Emission Report* - SO_x emissions were reported in tons per year for 1985.

[ffffff] For five areas (Boston NECMA, Springfield NECMA, Hartford NECMA, South Coast Air Basin, and San Joaquin Valley Air Basin), the geographical definition of the nonattainment areas differed slightly from that used in the analyses discussed above. In these cases, EPA relied on estimates of emissions from highway and other sources that were developed in the most recent State Implementation Plans.

For both VOC and CO, the original estimates of nonroad mobile source emissions from the Phase II and Cold CO emission inventories could not be readily distinguished from other area sources. To avoid counting nonroad sources among other area and point sources, EPA computed the ratio of nonroad to the sum of nonroad and other area and point sources for both VOC and CO emissions in each nonattainment area using data from the 1985 *National Emission Report*. These ratios were applied to the VOC and CO emissions from all nonhighway sources reported in the Phase II and Cold CO emission inventories. It was thus possible to estimate emissions from all other area and point sources without including nonroad engines and vehicles.

Emissions from highway vehicles and other area and point sources are shown in Tables 2-10 and 2-11, respectively. The data sources are also indicated by area in these tables.

These total inventories do not include emissions of VOCs from vegetation (biogenic VOCs). Although recent studies have shown that, in some cities, emissions of VOCs from plants may be more important in ozone formation than previously thought, EPA has only recently completed a computer model for estimating biogenic emissions in urban areas and has determined that reliable biogenic inventories do not exist for most areas. While the biogenic inventories to be included in future State Implementation Plans will affect the fine-tuning of nonattainment areas' pollution control strategies, the magnitude of VOC inventories from biogenic sources will not alter the need to reduce anthropogenic VOCs substantially to bring many urban areas into attainment of the ozone standard.

Table 2-10. Emissions from Highway Vehicles

Highway Vehicle Emissions

Geographical Area	tpy VOC	tpy NOx	tpy CO	tpy PM	tpy Aldehydes	tpy SOx	tpsd VOC	tpsd NOx	tpsd CO	Data Sources VOC	Data Sources NOx	Data Sources CO	Data Sources PM/SOx
Baltimore CMSA	ND	84,317	ND	ND	ND	ND	200.00	163.70	1,327.50	2	3	4	
Chicago CMSA	ND	153,215	ND	113,525	ND	ND	587.70	461.74	ND	2	3		
Denver CMSA	ND	ND	417,408	32,716	ND	ND	ND	ND	2,371.20			4	3
Houston CMSA	ND	100,866	ND	ND	ND	ND	442.40	303.98	ND	2	3		
Milwaukee CMSA	ND	33,493	ND	ND	ND	ND	105.70	100.94	ND	2	3		
Boston NECMA	ND	ND	ND	ND	ND	ND	414.98	206.93	1,470.00	1	1	1	
Hartford NECMA	ND	29,311	108,380	ND	ND	ND	188.50	88.33	580.00	1	3	1	
New York CMSA/NECMA	ND	317,257	3,129,400	232,789	ND	ND	1,114.10	866.12	7,373.40	2	3	4	3
Philadel. CMSA	ND	123,720	868,868	ND	ND	ND	431.50	372.86	ND	2	3		
Seat.-Tac. CMSA	ND	ND	287,870	30,161	ND	ND	ND	ND	1,514.80			4	3
Atlanta CMSA	ND	69,146	ND	ND	ND	ND	318.80	206.38	ND	2	3		
Baton Rouge CMSA	ND	14,556	ND	ND	ND	ND	64.00	43.86	ND	2	3		
Cleveland CMSA	ND	64,806	412,340	46,729	ND	ND	241.80	186.31	2,369.90	2	3	4	3
El Paso CMSA	ND	11,156	320,700	7,278	ND	ND	36.30	33.62	756.80	2	3	4	3
San Jq. Val. AB	ND	ND	ND	13,506	ND	9,125.00	150.00	240.00	1,100.00	1	1	1	1
South Coast AB	ND	ND	ND	34,676	ND	11,680.00	660.00	660.00	9,732.00	1	1	4	1
Miami CMSA	ND	63,266	ND	ND	ND	ND	306.80	190.86	ND	2	3		
Min.-St.Paul CMSA	ND	ND	419,140	42,282	ND	ND	ND	ND	2,421.70			4	3
Provo-Orem CMSA	ND	ND	73,804	3,668	ND	ND	ND	ND	440.40			4	3
San Diego AB	ND	47,136	670,100	6,936	ND	2,409.00	129.70	142.06	1,343.20	2	3	4	1
Spokane CMSA	ND	ND	9,026	3,881	ND	ND	ND	ND	261.20			4	3
St. Louis CMSA	ND	62,036	ND	36,069	ND	ND	207.70	186.97	1,709.80	2	3	4	3
Washington DC CMSA	ND	83,068	398,686	ND	ND	ND	346.00	250.34	2,180.80	2	3	4	
Springfield NECMA	ND	ND	ND	ND	ND	ND	62.47	30.30	ND	1	1		
Nation	5,639,464	6,547,763	36,034,743	1,387,736	ND	652,572.00	16,986.61	19,732.86	84,903.78	5	5	5	5

ND - No Data

1. State Implementation Plan
2. Phase II Volatility Control Support Runs
3. 1986 National Emission Report
4. Cold Carbon Monoxide Support Runs
5. 1989 National Air Pollutant Emission Estimates

Table 2-11. Emissions from Other Area and Point Sources

Other Area and Point Source Emissions

Geographical Area	tpy VOC	tpy NOx	tpy CO	tpy PM	tpy Aldehydes	tpy SOx	tped VOC	tped NOx	tped CO	Data Sources VOC	Data Sources NOx	Data Sources CO	Data Sources PM/SOx
Baltimore CMSA	ND	59,976	34,482	ND	ND	ND	226.00	164.32	225.86	2	3	4	
Chicago CMSA	ND	302,107	ND	181,246	ND	ND	1,029.00	603.01	ND	2	3		
Denver CMSA	ND	ND	88,870	146,677	ND	ND	ND	ND	167.58			4	
Houston CMSA	ND	440,925	ND	ND	ND	ND	1,391.00	859.40	ND	2	3		
Milwaukee CMSA	ND	39,621	ND	ND	ND	ND	196.00	108.55	ND	2	3		
Boston NECMA	ND	ND	ND	ND	ND	ND	304.40	168.62	590.54	1	1	1	
Hartford NECMA	ND	11,650	61,997	ND	ND	ND	78.85	18.08	210.00	1	1	1	
New York CMSA/NECMA	ND	232,862	546,500	119,873	ND	ND	1,578.00	638.03	803.96	2	3	4	
Philadel. CMSA	ND	137,579	178,772	ND	ND	ND	911.00	376.93	ND	2	3		
Seat.-Tac. CMSA	ND	ND	169,879	37,878	ND	ND	ND	ND	564.87			4	
Atlanta CMSA	ND	92,553	ND	ND	ND	ND	287.00	248.24	ND	2	3		
Baton Rouge CMSA	ND	82,744	ND	ND	ND	ND	270.00	226.70	ND	2	3		
Cleveland CMSA	ND	62,301	88,401	64,287	ND	ND	360.00	170.69	251.62	2	3	4	
El Paso CMSA	ND	20,382	18,000	129,930	ND	ND	60.00	24.87	24.31	2	3	4	
San Jq. Val. AB	ND	ND	ND	731,789	ND	16,790.00	1,022.10	248.70	683.20	1	1	1	1
South Coast AB	ND	ND	ND	786,500	ND	18,213.50	1,400.00	333.80	265.00	1	1	1	1
Miami CMSA	ND	35,464	ND	ND	ND	ND	235.00	97.16	ND	2	3		
Min.-St.Paul CMSA	ND	63,307	125,911	214,398	ND	ND	ND	173.44	356.71			4	
Provo-Orem CMSA	ND	ND	38,273	45,615	ND	ND	ND	ND	38.38			4	
San Diego AB	ND	ND	94,000	179,215	ND	3,723.00	271.00	34.10	153.63	2	1	4	1
Spokane CMSA	ND	ND	77,748	9,837	ND	ND	ND	ND	223.79			4	
St. Louis CMSA	ND	158,510	ND	89,636	ND	ND	360.00	434.27	441.10	2	3	4	
Washington DC CMSA	ND	88,336	59,024	ND	ND	ND	202.00	242.02	186.74	2	3	4	
Springfield NECMA	ND	ND	ND	ND	ND	ND	49.66	29.99	ND	1	1		
Nation	13,684,163	13,955,333	24,480,414	6,384,620	ND	22,311,9[illegible].00	37,480.86	38,233.79	67,206.61	5	5	5	5

ND - No Data

1. State Implementation Plan
2. Phase II Volatility Control Support Runs
3. 1985 National Emission Report
4. Cold Carbon Monoxide Support Runs
5. 1989 National Air Pollutant Emission Estimates

Chapter 3. Results

As described in Chapter 2, EPA developed two new sets of inventories for nonroad engines and vehicles. Inventory A was developed from data supplied by EPA contractors, and Inventory B incorporated information supplied by manufacturers.

Both inventories were developed by multiplying the activity levels by the appropriate emission factors. Where possible, the resulting data were compared to emission inventories for highway mobile sources and other area and point sources.

The results of Inventories A and B are summarized in this chapter. Detailed presentations of both inventories can be found in Appendixes M (Inventory A) and O (Inventory B). This chapter also contains a summary of the results from EPA's analysis of SIP and CARB inventories.

3.1. VOC, NO_x, CO, and Particulate Nonroad Inventories

Table 3-01 presents nonroad emissions of VOC, NO_x, CO, and particulates as percentages of the total emission inventory for each of the 24 nonattainment areas studied. For each entry, a range is provided. The lower end of each range was calculated using new engine emission factors, while the upper end utilized in-use emission factors.

Due to the seasonal nature of ozone and CO nonattainment in many areas, EPA made adjustments to the emission inventories developed for VOC, NO_x, and CO. The results are reported as percentage tons per summer day for VOC and NO_x and percentage tons per winter day for CO. Table 3-01 also provides a comparison of results from Inventory A and Inventory B.

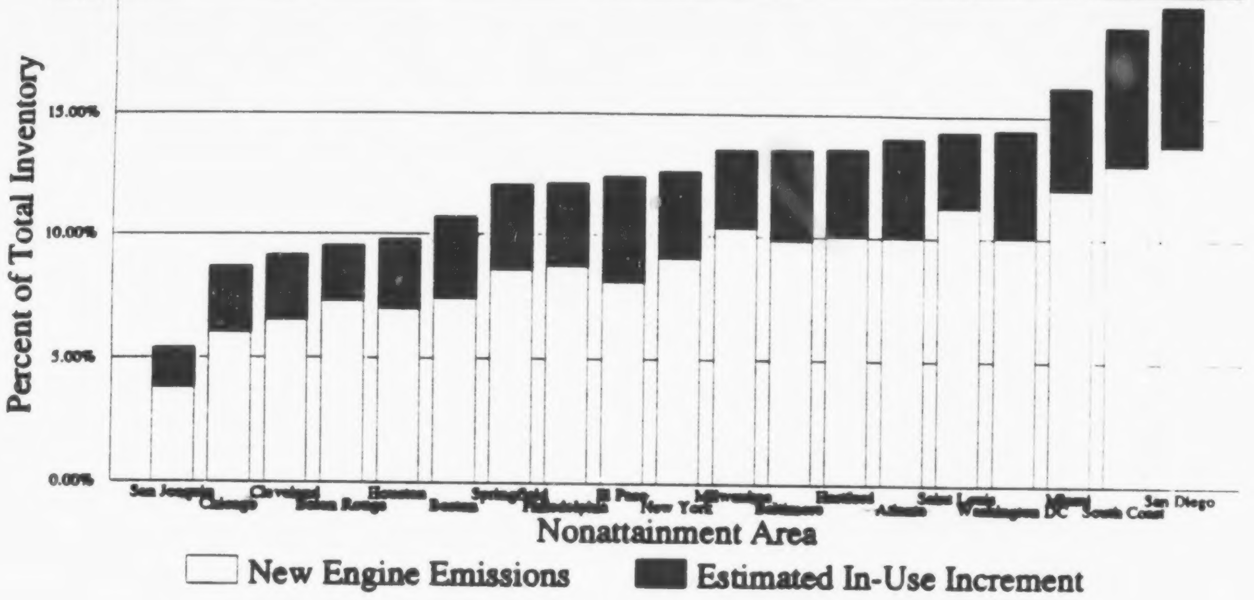
To help visualize the nonroad contribution to total local emission inventories, stacked bar charts are used to display the distribution of the results from Table 3-01 in eight charts following the table. Calculations using both new engine and in-use emission factors are presented in each chart to illustrate the range of potential nonroad emission contributions. Of the 24 nonattainment areas included in the inventories, 19 were studied for NO_x and VOC, 16 were studied for CO, and 13 were studied for particulates.

Table 3-01. Total Nonroad Emissions by Nonattainment Area and Pollutant (%)

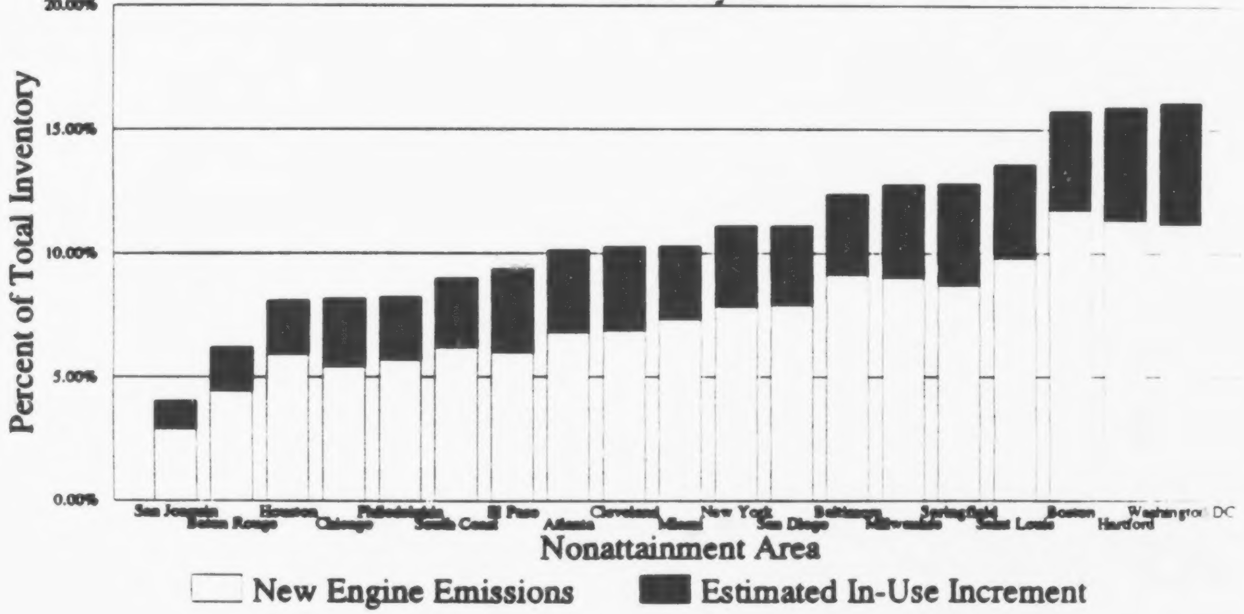
Nonattainment Area	Inventory A				Inventory B			
	VOC tpsd (%)	NO_x tpsd (%)	CO tpwd (%)	PM tpy (%)	VOC tpsd (%)	NO_x tpsd (%)	CO tpwd (%)	PM tpy (%)
Atlanta	10-14*	13			7-10	13		
Baltimore	10-14	19	11-14		9-12	18	11-14	
Baton Rouge	7-10	13			4-6	8		
Boston	7-11	19	9-15		12-16	25	8-13	
Chicago	6-9	16		2	5-8	12		1
Cleveland	7-9	15	5-8	2	7-10	12	4-7	1
Denver			6-9	1			5-8	0.5
El Paso	8-12	22	5-8	0.4	6-9	15	4-7	0.2
Hartford	10-14	25	9-13		11-16	31	4-11	
Houston	7-10	15			6-8	10		
Miami	12-16	18			7-10	16		
Milwaukee	10-14	16			9-13	13		
Minneapolis			4-7	1			3-6	0.7
New York	9-13	20	9-14	3	8-11	14	8-13	2
Philadelphia	9-12	17			6-8	14		
Provo-Orem			3-4	0.4			2-4	0.3
San Diego	14-20	39	9-14	2	8-11	31	7-11	1
Seattle			9-12	5			9-11	3
South Coast, CA	13-19	29	8-13	2	6-9	20	6-9	0.7
San Joaquin Valley	4-5	19	6-10	0.6	3-4	17	5-8	0.4
Springfield, MA	9-12	15			9-13	15		
Spokane			2-4	2			2-4	1
St. Louis	11-14	12	5-8	2	10-14	10	4-7	1
Washington, DC	10-14	17	5-8		11-16	13	6-9	

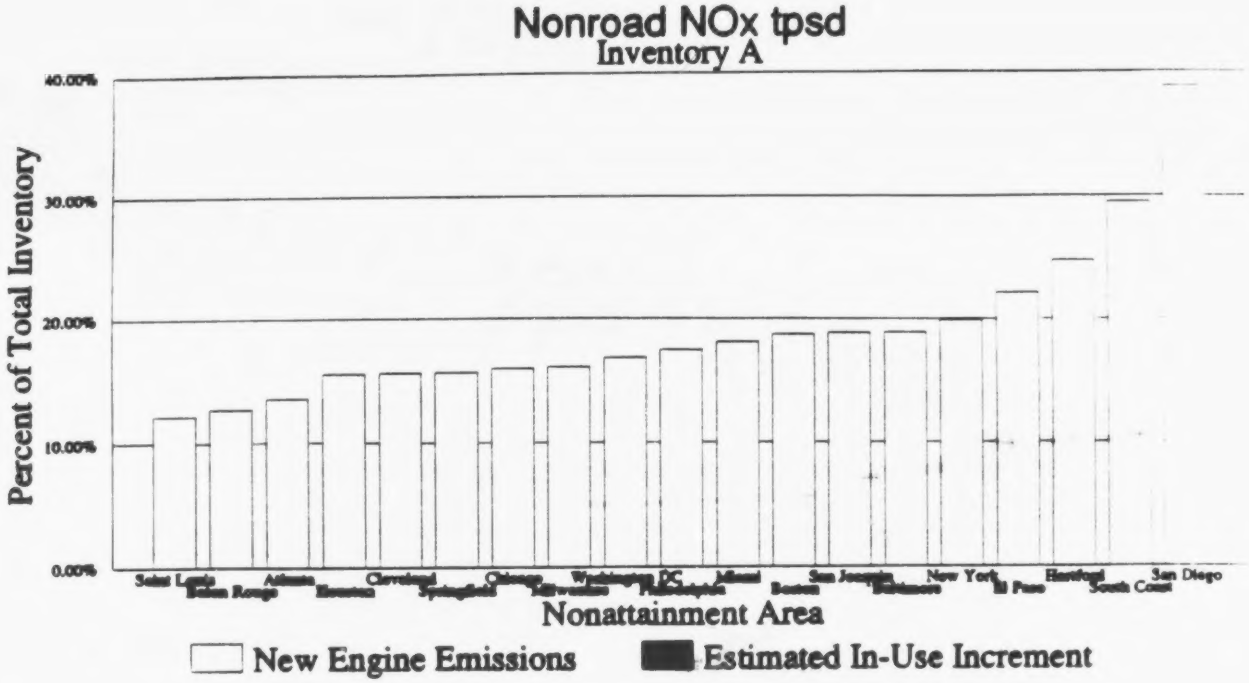
*The range presented is based on calculation of emissions from new and in-use emission factors.

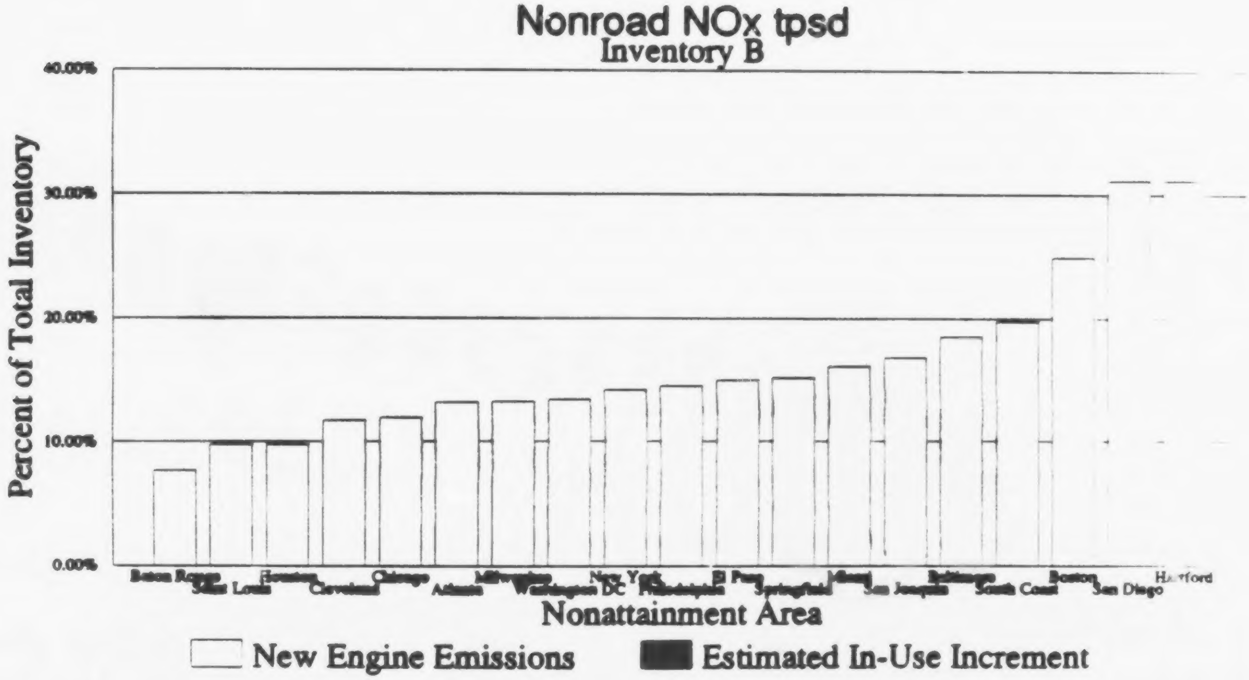
Nonroad VOC tpsd
Inventory A

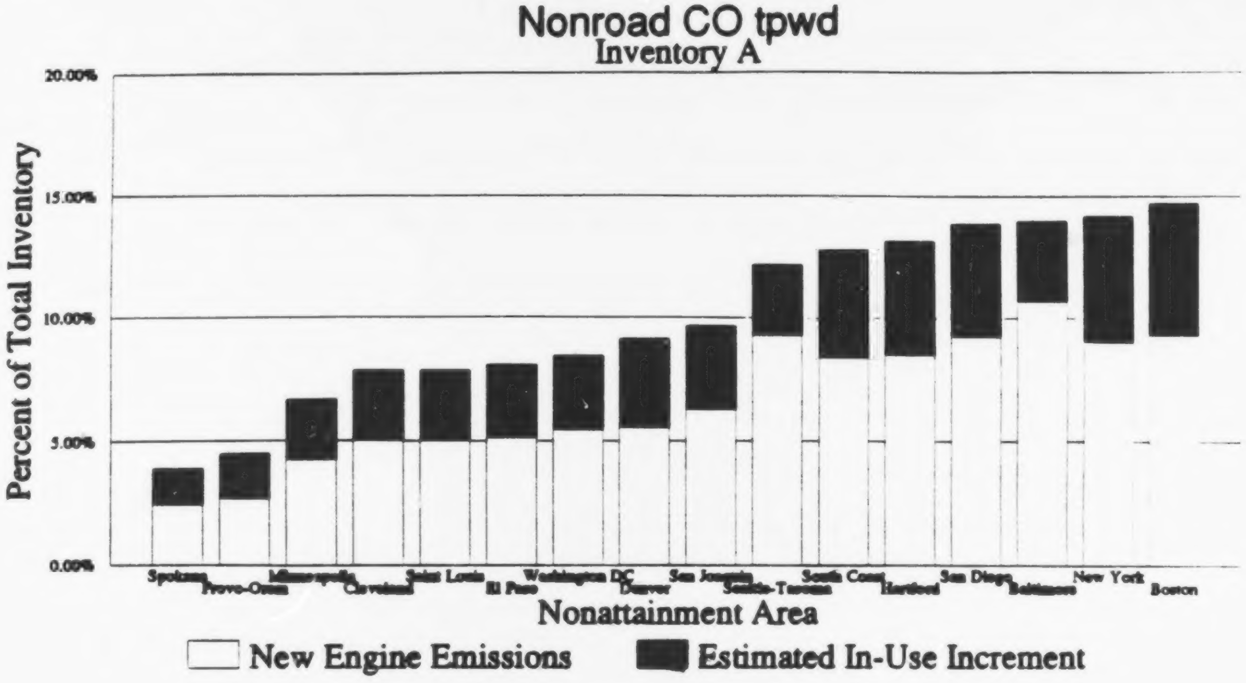


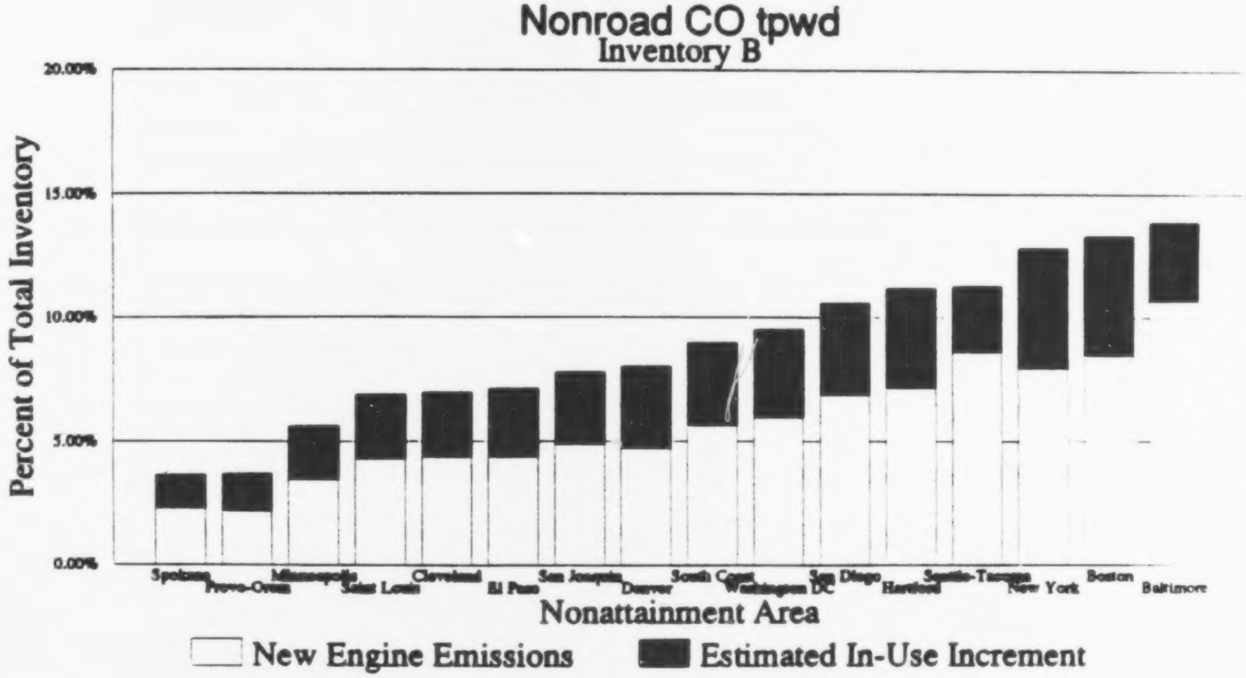
Nonroad VOC tpsd
Inventory B

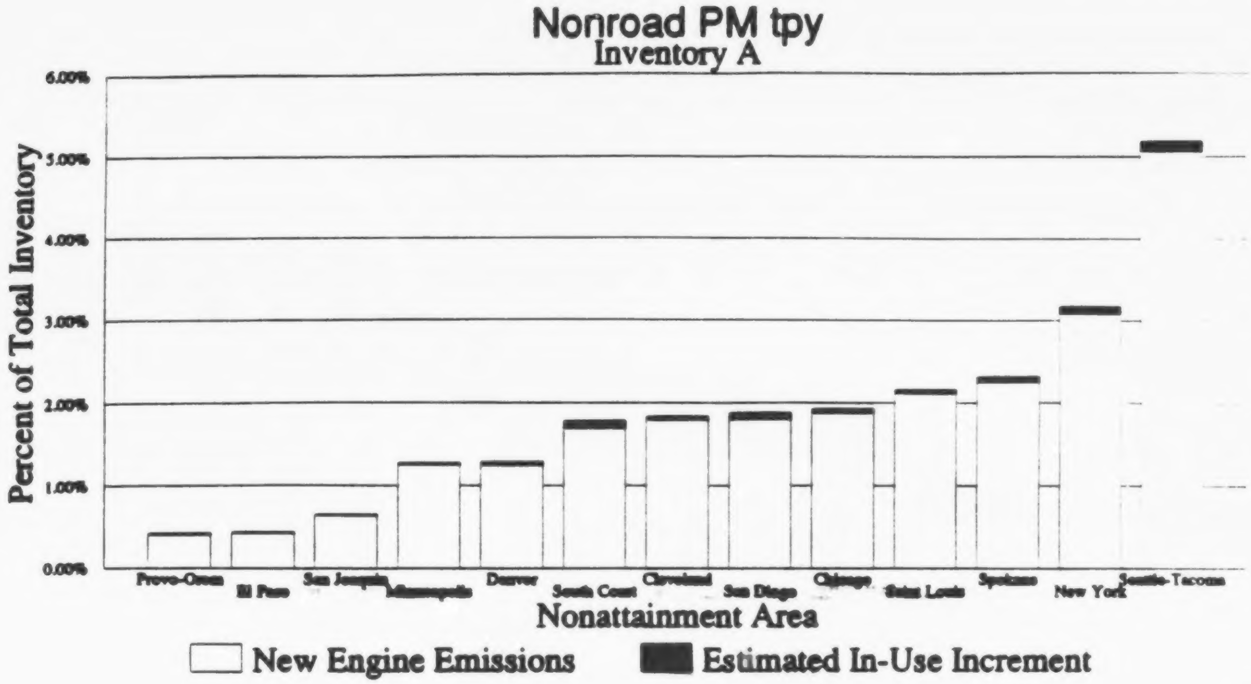


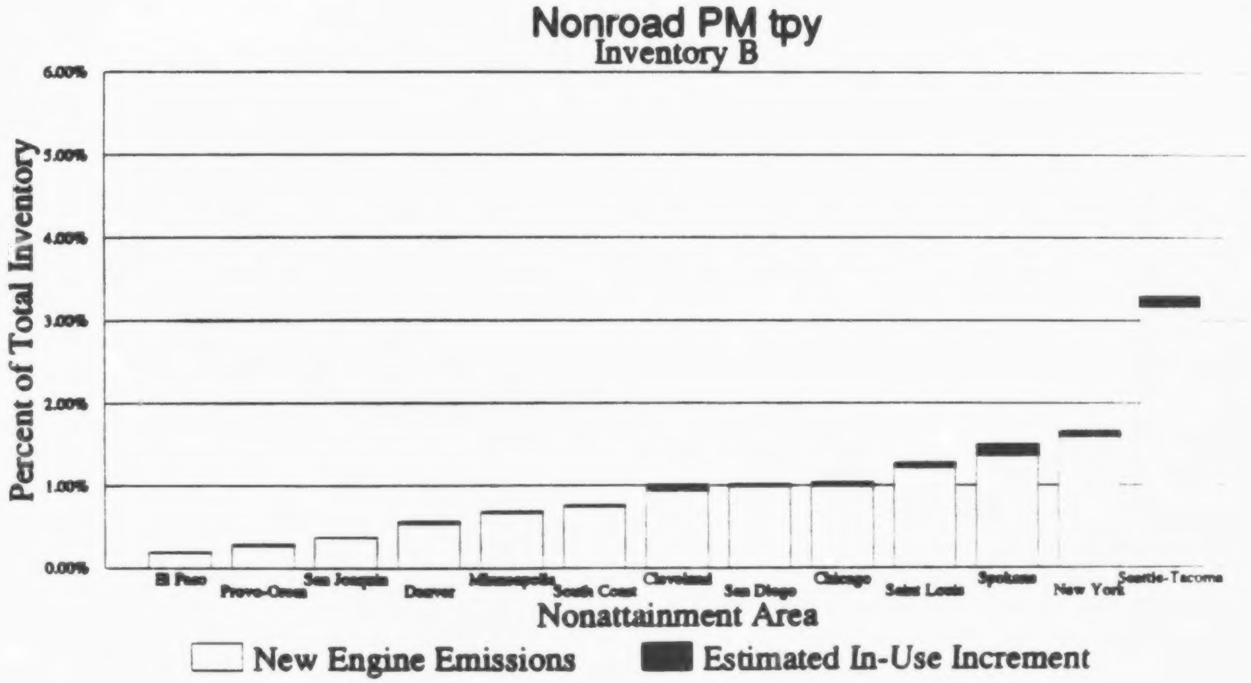

Nonroad NOx tpsd
Inventory A
40.00%
30.00%
20.00%
10.00%
0.00%
Percent of Total Inventory
Saint Louis
Baton Rouge
Atlanta
Houston
Cleveland
Springfield
Chicago
Milwaukee
Washington DC
Philadelphia
Miami
Boston
San Joaquin
Baltimore
New York
El Paso
Hartford
South Coast
San Diego
Nonattainment Area
New Engine Emissions
Estimated In-Use Increment


Nonroad NOx tpsd
Inventory B
40.00%
30.00%
20.00%
10.00%
0.00%
Percent of Total Inventory
Baton Rouge
Saint Louis
Houston
Cleveland
Chicago
Atlanta
Milwaukee
Washington DC
New York
Philadelphia
El Paso
Springfield
Miami
San Joaquin
Baltimore
South Coast
Boston
San Diego
Hartford
Nonattainment Area
New Engine Emissions
Estimated In-Use Increment


Nonroad CO tpwd
Inventory A
Percent of Total Inventory
20.00%
15.00%
10.00%
5.00%
0.00%
Spokane
Provo-Orem
Minneapolis
Cleveland
Saint Louis
El Paso
Washington DC
Denver
San Joaquin
Seattle-Tacoma
South Coast
Hartford
San Diego
Baltimore
New York
Boston
Nonattainment Area
New Engine Emissions
Estimated In-Use Increment

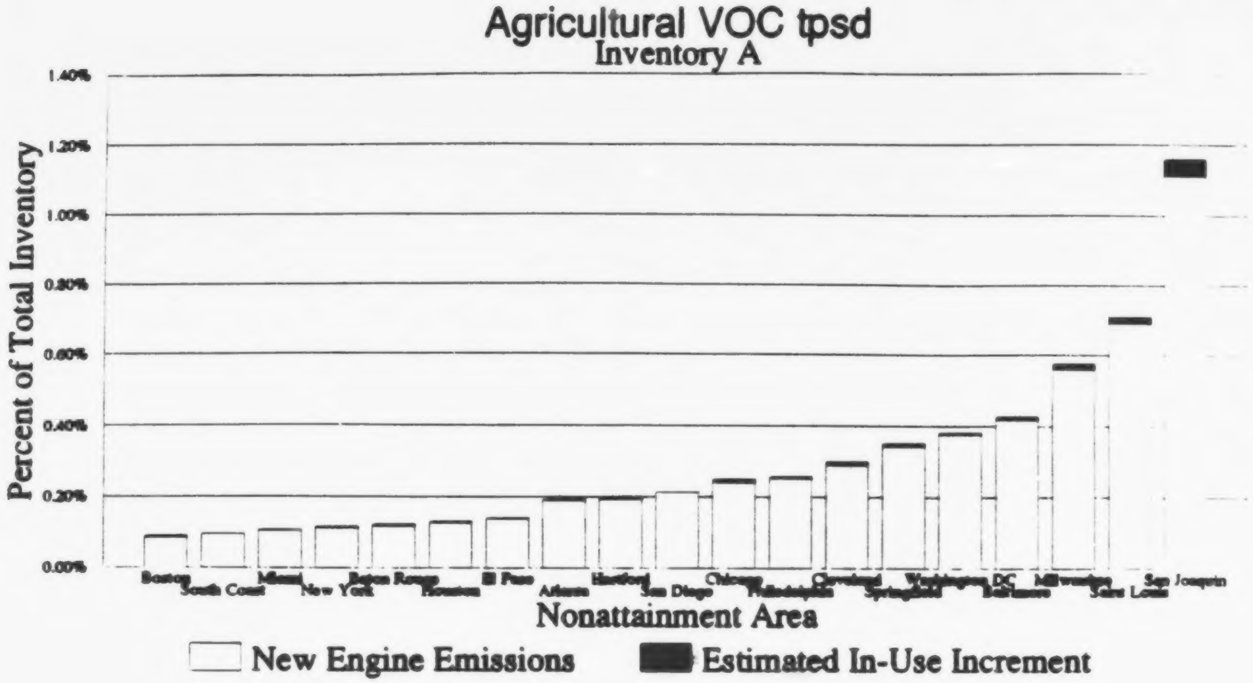

Nonroad CO tpwd
Inventory B
Percent of Total Inventory
20.00%
15.00%
10.00%
5.00%
0.00%
Spokane
Provo-Orem
Minneapolis
Saint Louis
Cleveland
El Paso
San Joaquin
Denver
South Coast
Washington DC
San Diego
Hartford
Seattle-Tacoma
New York
Boston
Baltimore
Nonattainment Area
New Engine Emissions
Estimated In-Use Increment

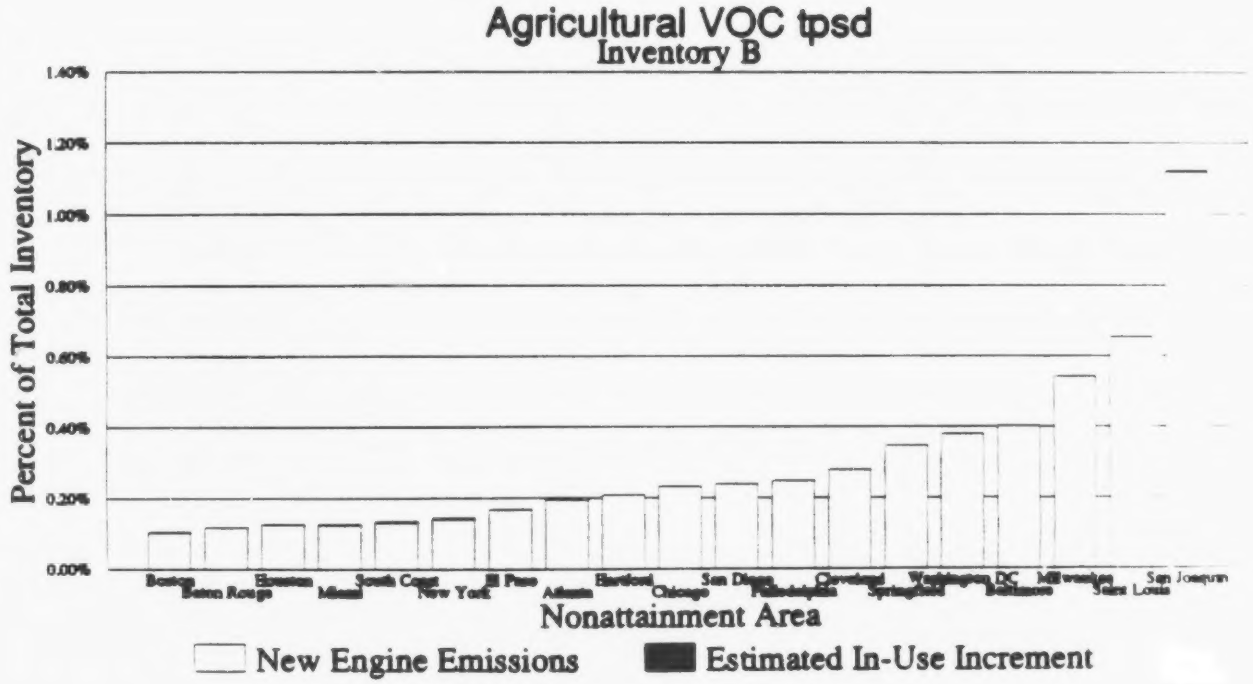

Nonroad PM tpy
Inventory A
Percent of Total Inventory
6.00%
5.00%
4.00%
3.00%
2.00%
1.00%
0.00%
Provo-Orem
El Paso
San Joaquin
Minneapolis
Denver
South Coast
Cleveland
San Diego
Chicago
Saint Louis
Spokane
New York
Seattle-Tacoma
Nonattainment Area
New Engine Emissions
Estimated In-Use Increment

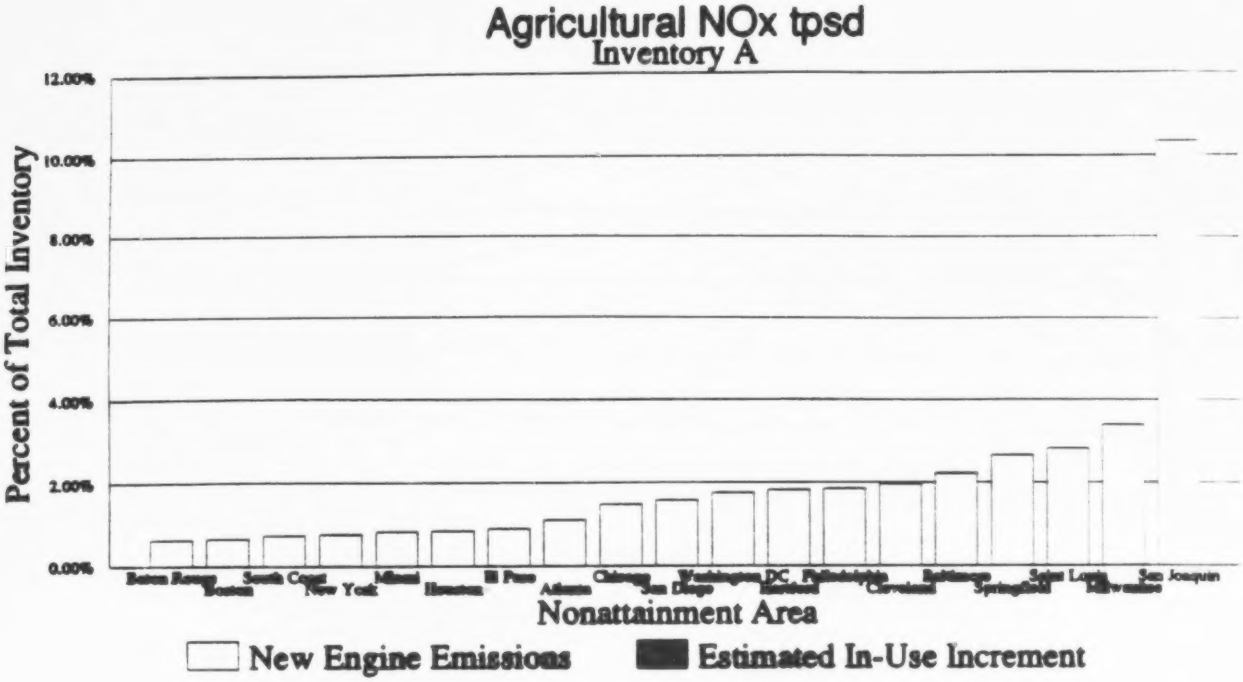

Nonroad PM tpy
Inventory B
Percent of Total Inventory
6.00%
5.00%
4.00%
3.00%
2.00%
1.00%
0.00%
El Paso
Provo-Orem
San Joaquin
Denver
Minneapolis
South Coast
Cleveland
San Diego
Chicago
Saint Louis
Spokane
New York
Seattle-Tacoma
Nonattainment Area
New Engine Emissions
Estimated In-Use Increment

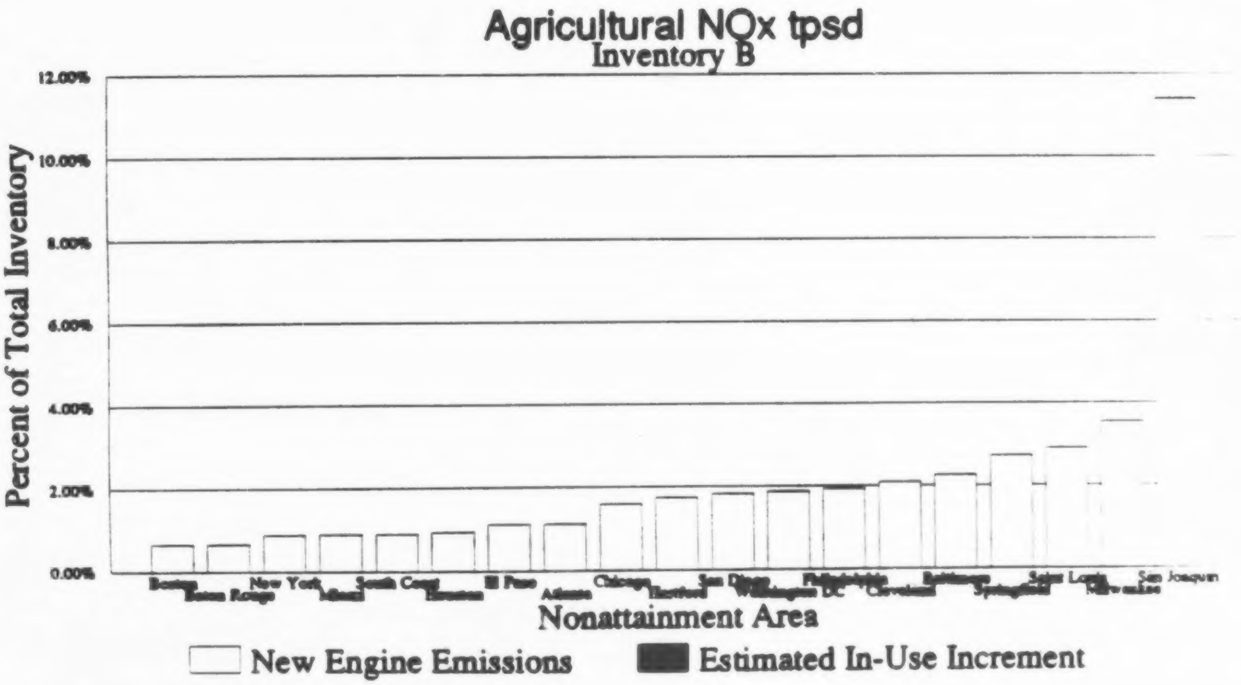
3.2. VOC, NO_x, CO, and Particulate Nonroad Inventories by Categories

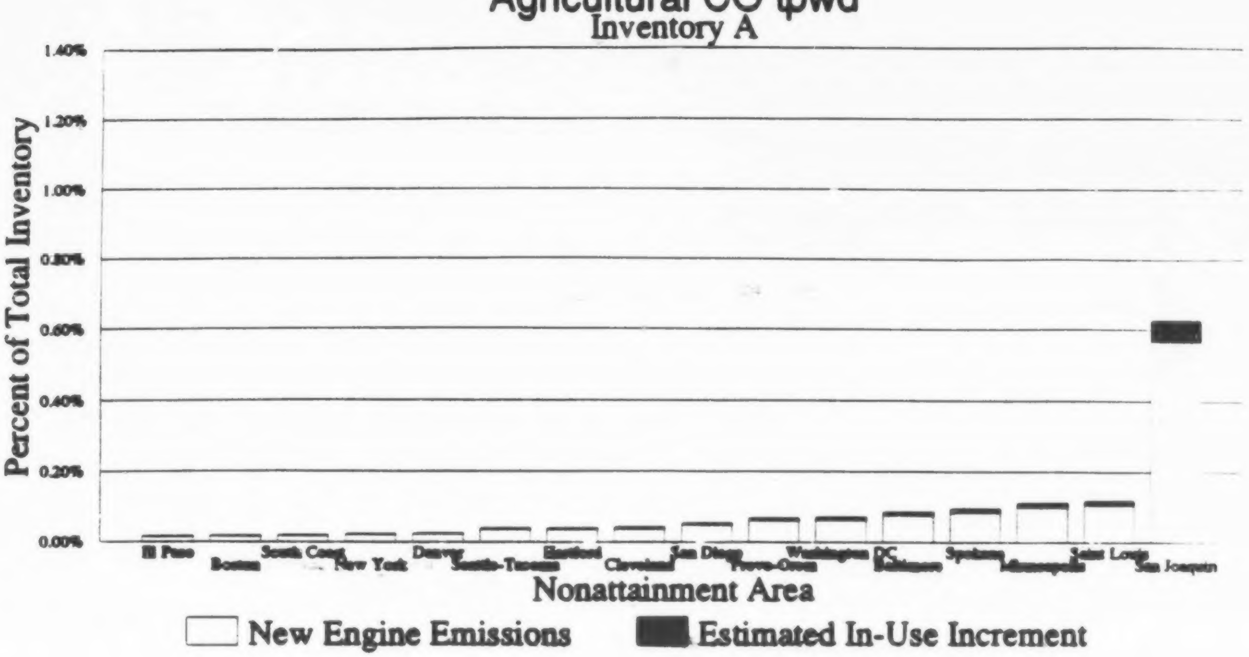
The following charts summarize the contribution of each category of nonroad equipment to total emission inventories. Each chart presents the VOC, NO_x, CO, and particulate contribution determined by each of the two inventory methods for one equipment category.

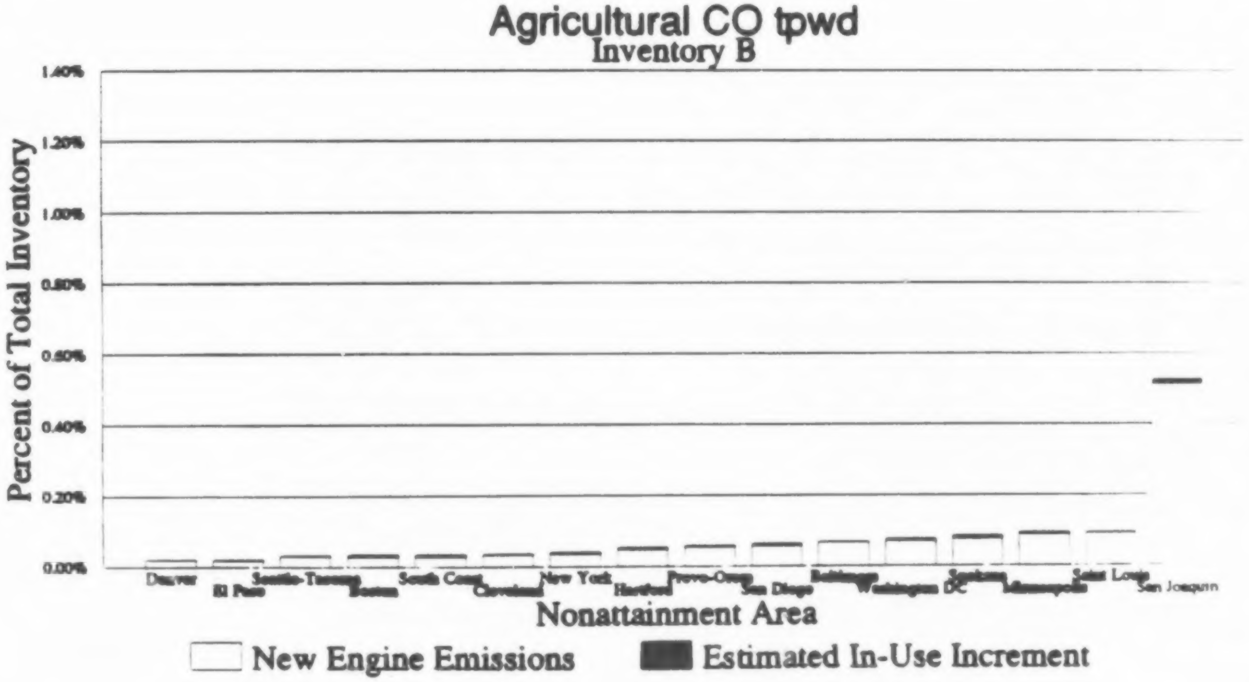

Agricultural VOC tpsd
Inventory A
Percent of Total Inventory
1.40%
1.20%
1.00%
0.80%
0.60%
0.40%
0.20%
0.00%
Boston
South Coast
Miami
New York
Baton Rouge
Houston
El Paso
Atlanta
Hartford
San Diego
Chicago
Philadelphia
Cleveland
Springfield
Washington DC
Baltimore
Milwaukee
Saint Louis
San Joaquin
Nonattainment Area
New Engine Emissions
Estimated In-Use Increment

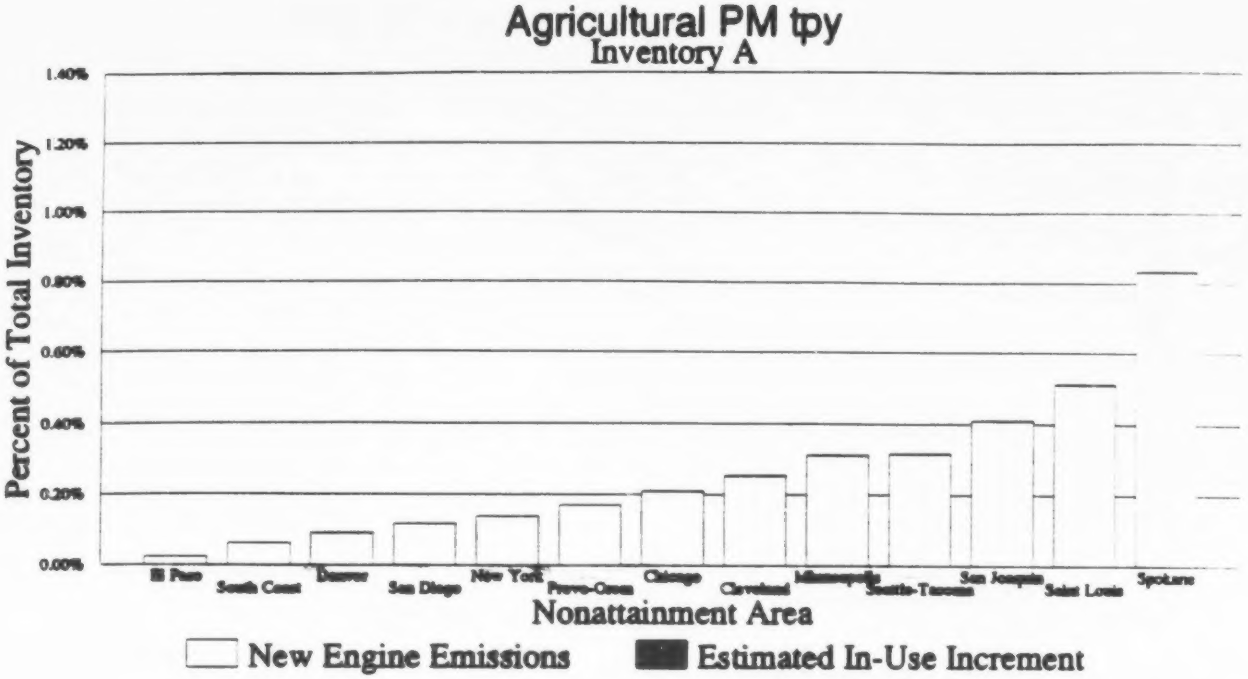

Agricultural VOC tpsd
Inventory B
Percent of Total Inventory
1.40%
1.20%
1.00%
0.80%
0.60%
0.40%
0.20%
0.00%
Boston
Baton Rouge
Houston
Miami
South Coast
New York
El Paso
Atlanta
Hartford
Chicago
San Diego
Philadelphia
Cleveland
Springfield
Washington DC
Baltimore
Milwaukee
Saint Louis
San Joaquin
Nonattainment Area
New Engine Emissions
Estimated In-Use Increment

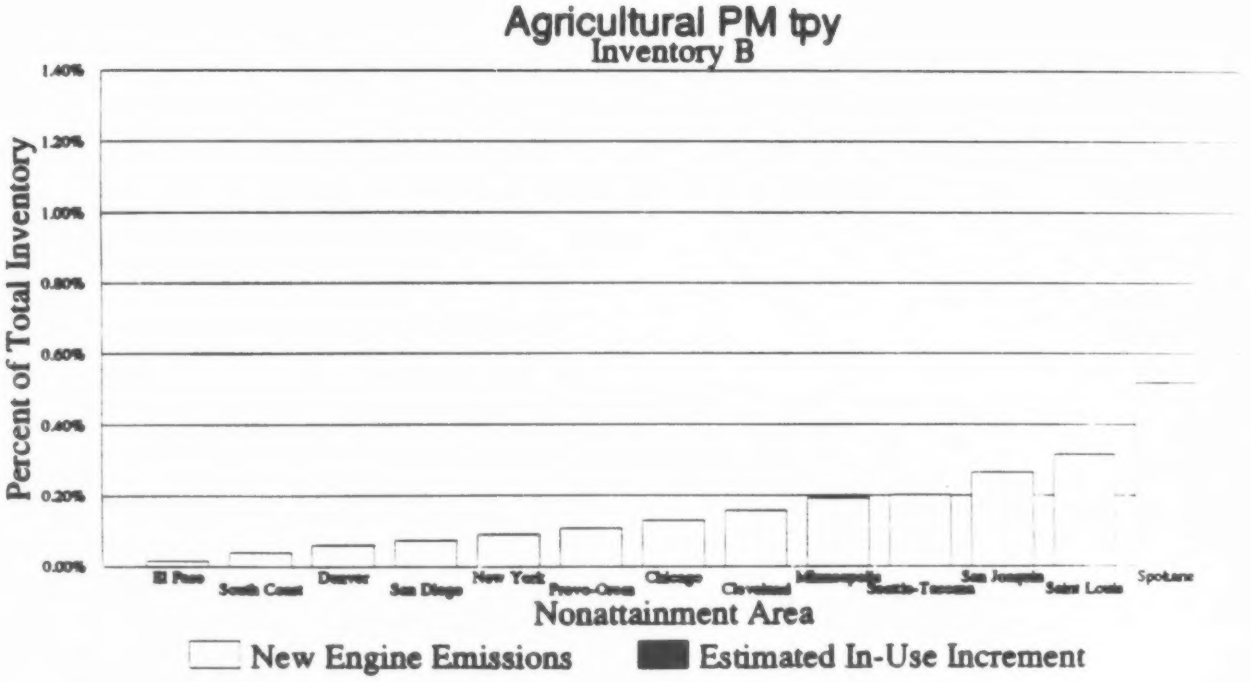

Agricultural NOx tpsd
Inventory A
12.00%
10.00%
8.00%
6.00%
4.00%
2.00%
0.00%
Percent of Total Inventory
Baton Rouge
Boston
South Coast
New York
Miami
Houston
El Paso
Atlanta
Chicago
San Diego
Washington DC
Hartford
Philadelphia
Cleveland
Baltimore
Springfield
Saint Louis
Milwaukee
San Joaquin
Nonattainment Area
New Engine Emissions
Estimated In-Use Increment

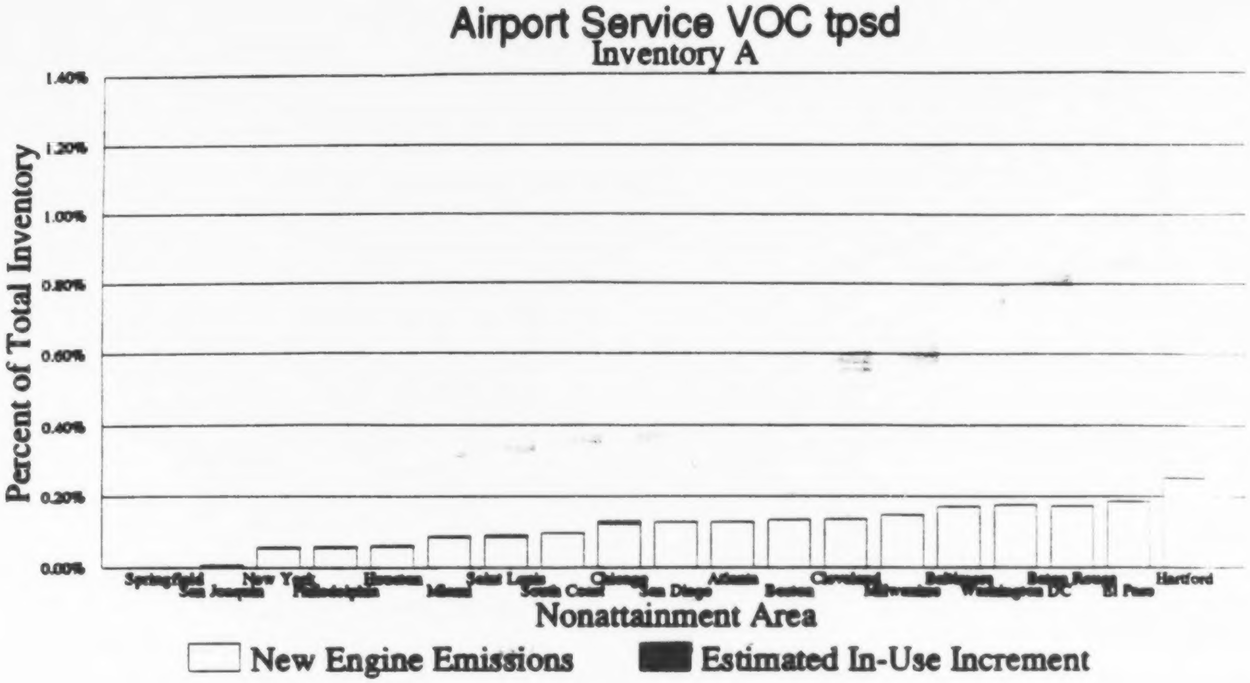

Agricultural NOx tpsd
Inventory B
12.00%
10.00%
8.00%
6.00%
4.00%
2.00%
0.00%
Percent of Total Inventory
Boston
Baton Rouge
New York
Miami
South Coast
Houston
El Paso
Atlanta
Chicago
Hartford
San Diego
Washington DC
Philadelphia
Cleveland
Baltimore
Springfield
Saint Louis
Milwaukee
San Joaquin
Nonattainment Area
New Engine Emissions
Estimated In-Use Increment

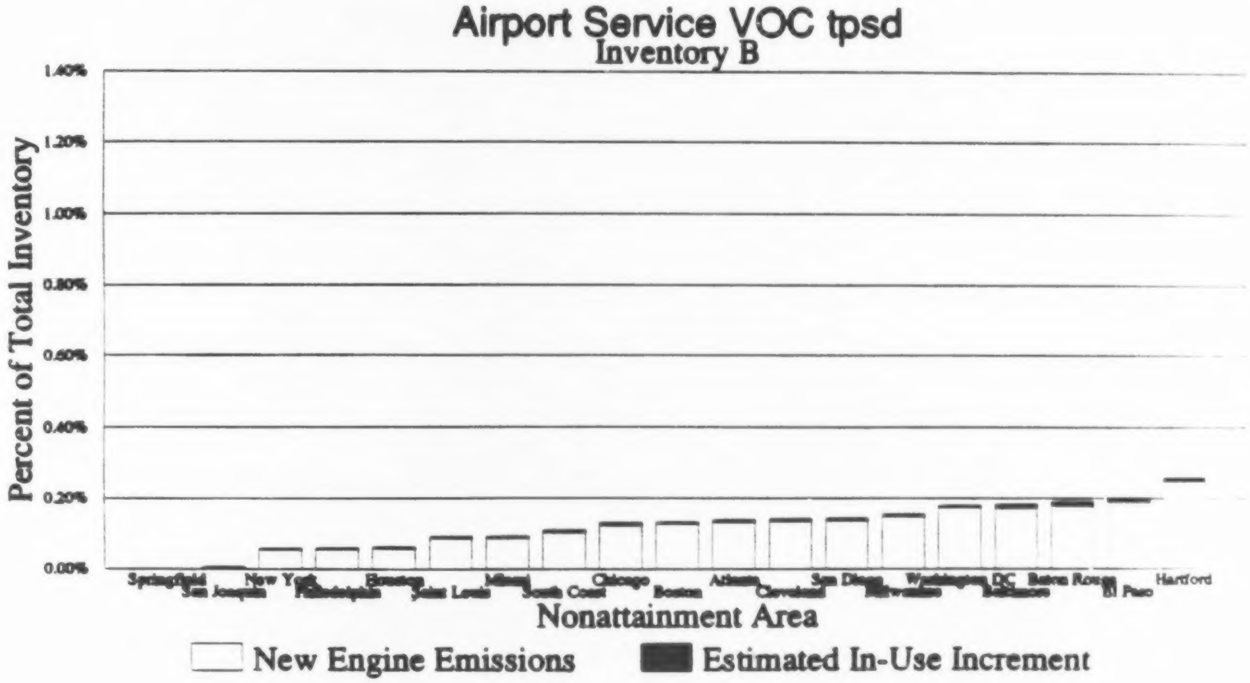

Agricultural CO tpwd
Inventory A
Percent of Total Inventory
1.40%
1.20%
1.00%
0.80%
0.60%
0.40%
0.20%
0.00%
El Paso
Boston
South Coast
New York
Denver
Seattle-Tacoma
Hartford
Cleveland
San Diego
Provo-Orem
Washington DC
Baltimore
Spokane
Minneapolis
Saint Louis
San Joaquin
Nonattainment Area
New Engine Emissions
Estimated In-Use Increment

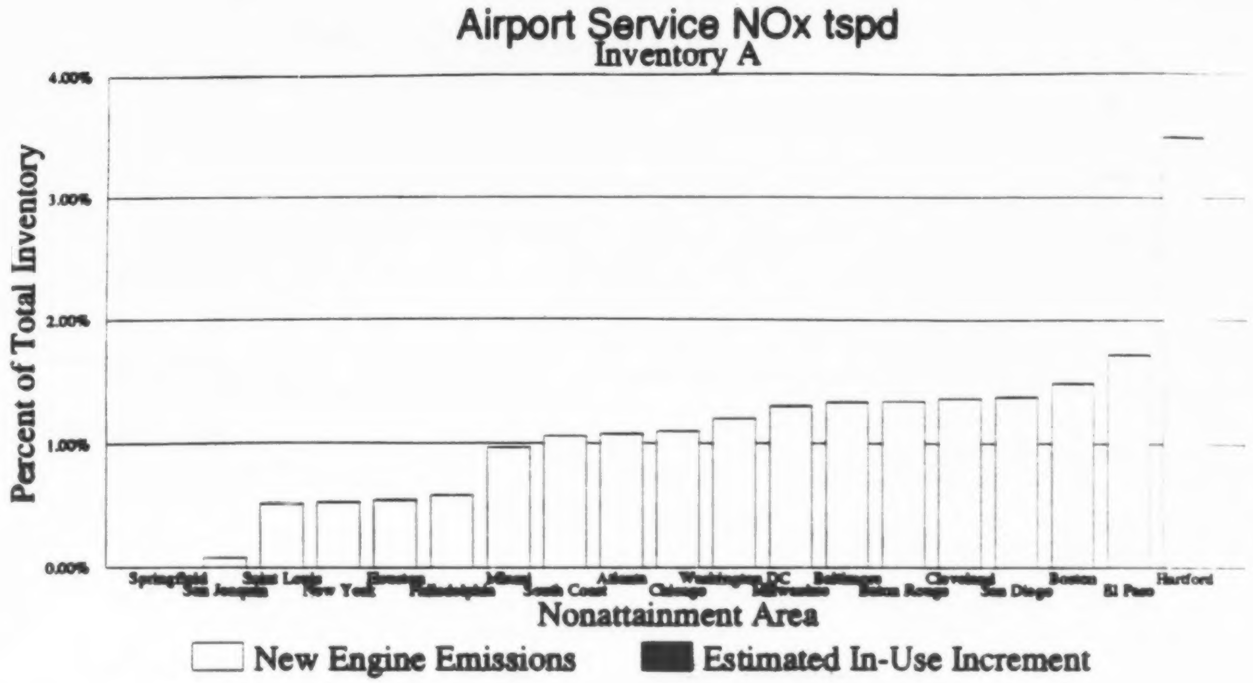

Agricultural CO tpwd
Inventory B
Percent of Total Inventory
1.40%
1.20%
1.00%
0.80%
0.60%
0.40%
0.20%
0.00%
Denver
El Paso
Seattle-Tacoma
Boston
South Coast
Cleveland
New York
Hartford
Provo-Orem
San Diego
Baltimore
Washington DC
Spokane
Minneapolis
Saint Louis
San Joaquin
Nonattainment Area
New Engine Emissions
Estimated In-Use Increment


Agricultural PM tpy
Inventory A
1.40%
1.20%
1.00%
0.80%
0.60%
0.40%
0.20%
0.00%
Percent of Total Inventory
El Paso
South Coast
Denver
San Diego
New York
Provo-Orem
Chicago
Cleveland
Minneapolis
Seattle-Tacoma
San Joaquin
Saint Louis
Spokane
Nonattainment Area
New Engine Emissions
Estimated In-Use Increment

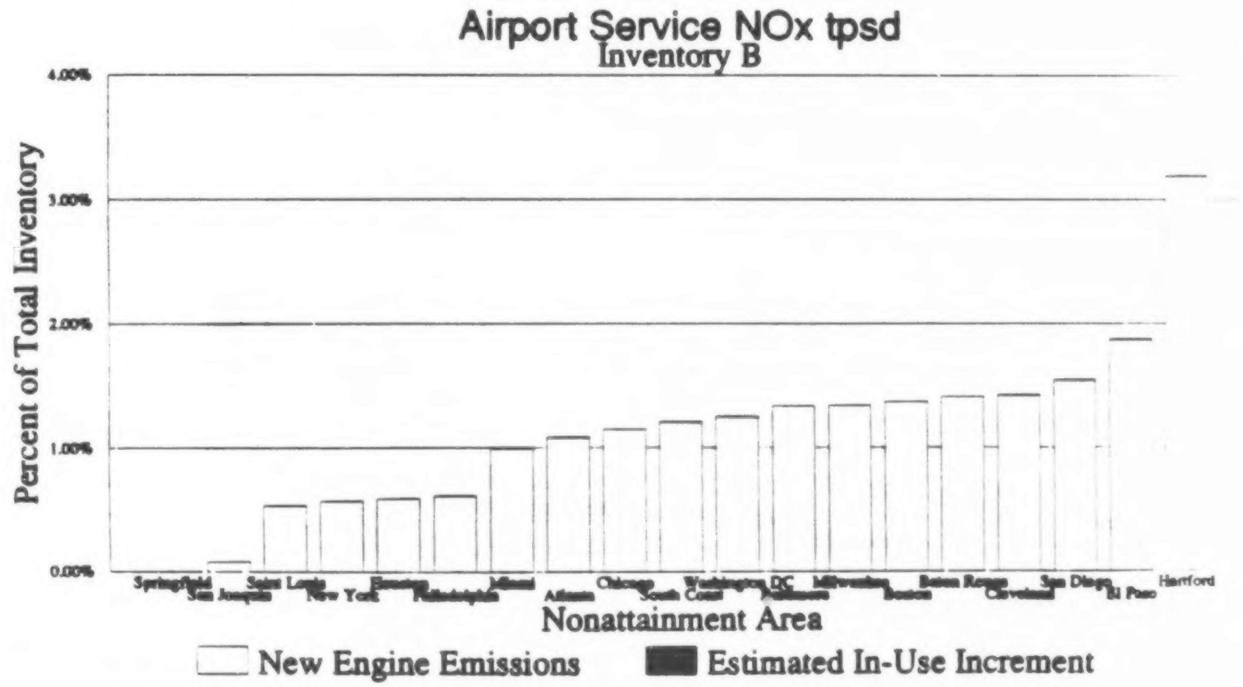

Agricultural PM tpy
Inventory B
1.40%
1.20%
1.00%
0.80%
0.60%
0.40%
0.20%
0.00%
Percent of Total Inventory
El Paso
South Coast
Denver
San Diego
New York
Provo-Orem
Chicago
Cleveland
Minneapolis
Seattle-Tacoma
San Joaquin
Saint Louis
Spokane
Nonattainment Area
New Engine Emissions
Estimated In-Use Increment


Airport Service VOC tpsd
Inventory A
Percent of Total Inventory
1.40%
1.20%
1.00%
0.80%
0.60%
0.40%
0.20%
0.00%
Springfield
San Joaquin
New York
Philadelphia
Houston
Miami
Saint Louis
South Coast
Chicago
San Diego
Atlanta
Boston
Cleveland
Milwaukee
Baltimore
Washington DC
Baton Rouge
El Paso
Hartford
Nonattainment Area
New Engine Emissions
Estimated In-Use Increment

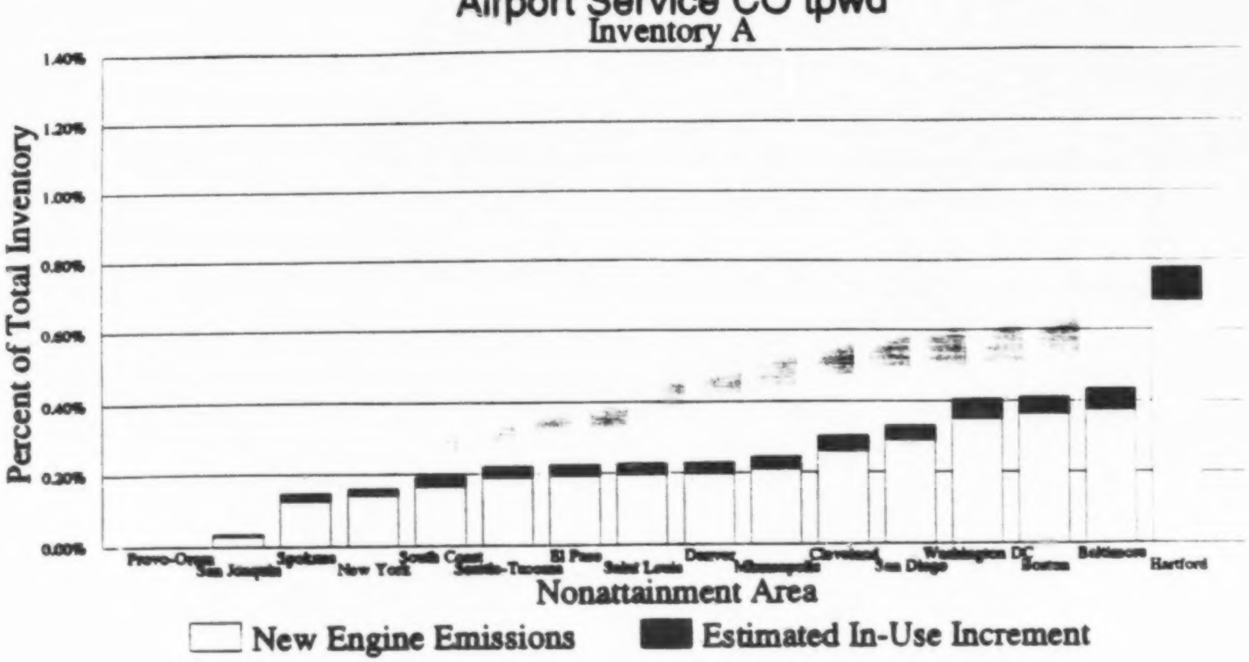

Airport Service VOC tpsd
Inventory B
Percent of Total Inventory
1.40%
1.20%
1.00%
0.80%
0.60%
0.40%
0.20%
0.00%
Springfield
San Joaquin
New York
Philadelphia
Houston
Saint Louis
Miami
South Coast
Chicago
Boston
Atlanta
Cleveland
San Diego
Milwaukee
Washington DC
Baltimore
Baton Rouge
El Paso
Hartford
Nonattainment Area
New Engine Emissions
Estimated In-Use Increment

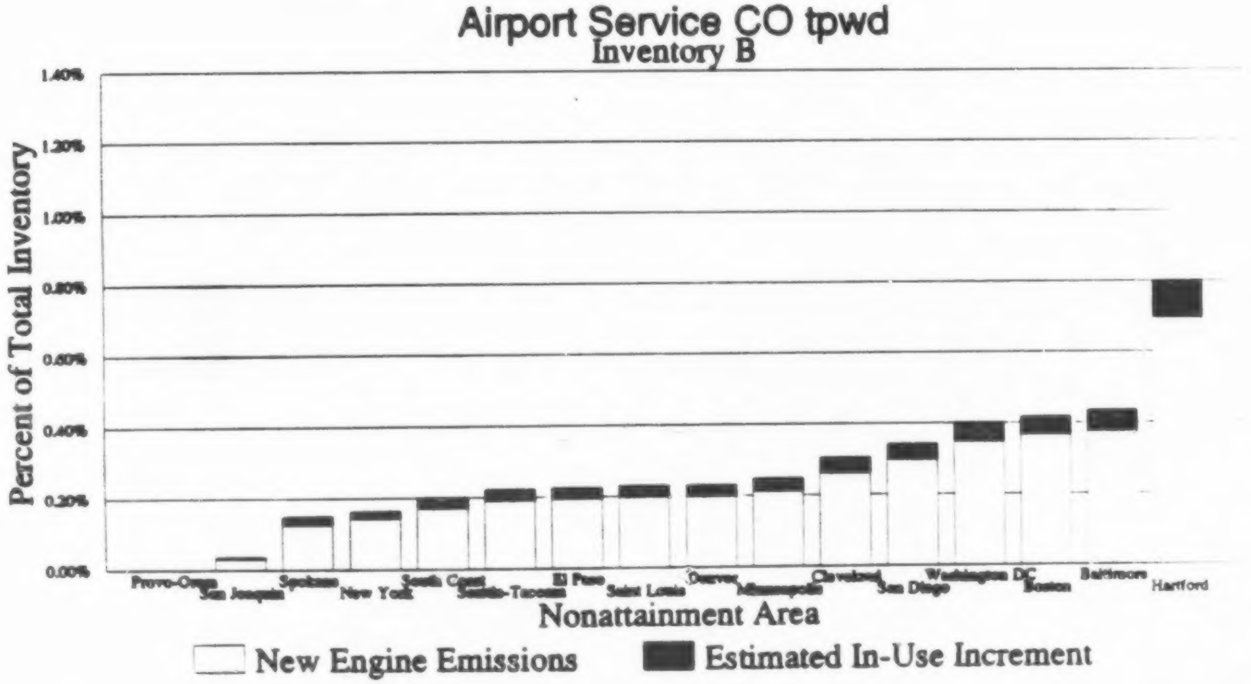


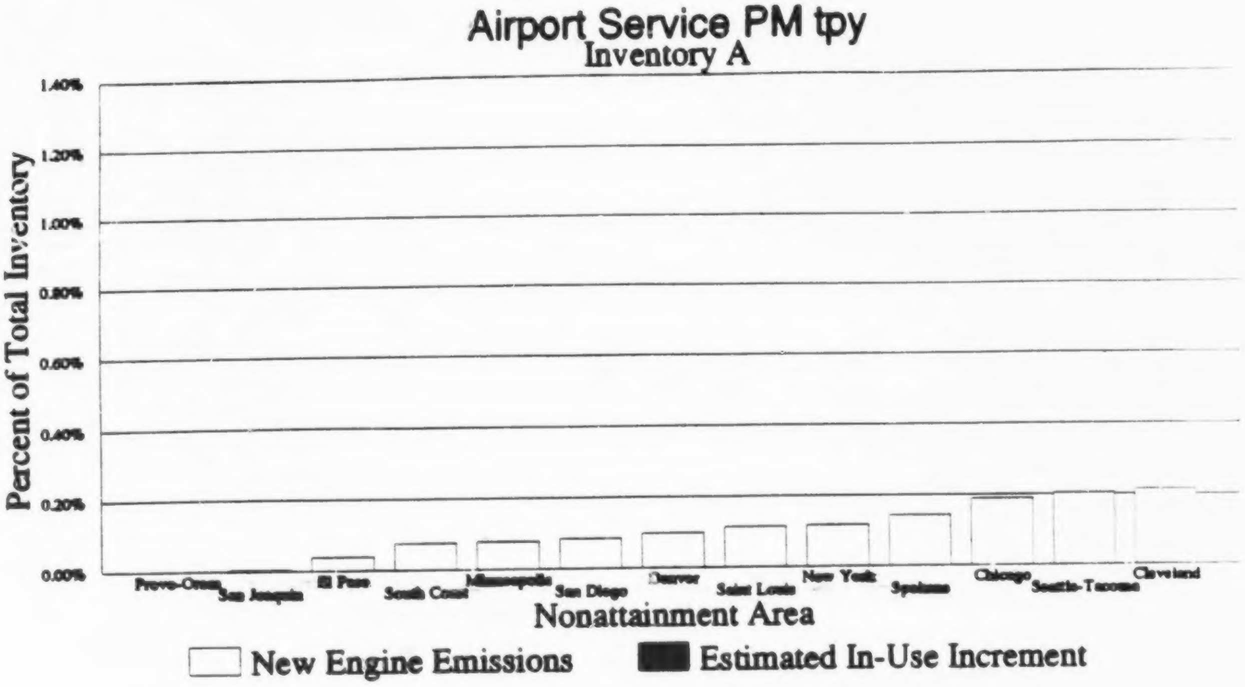
Airport Service NOx tspd
Inventory A

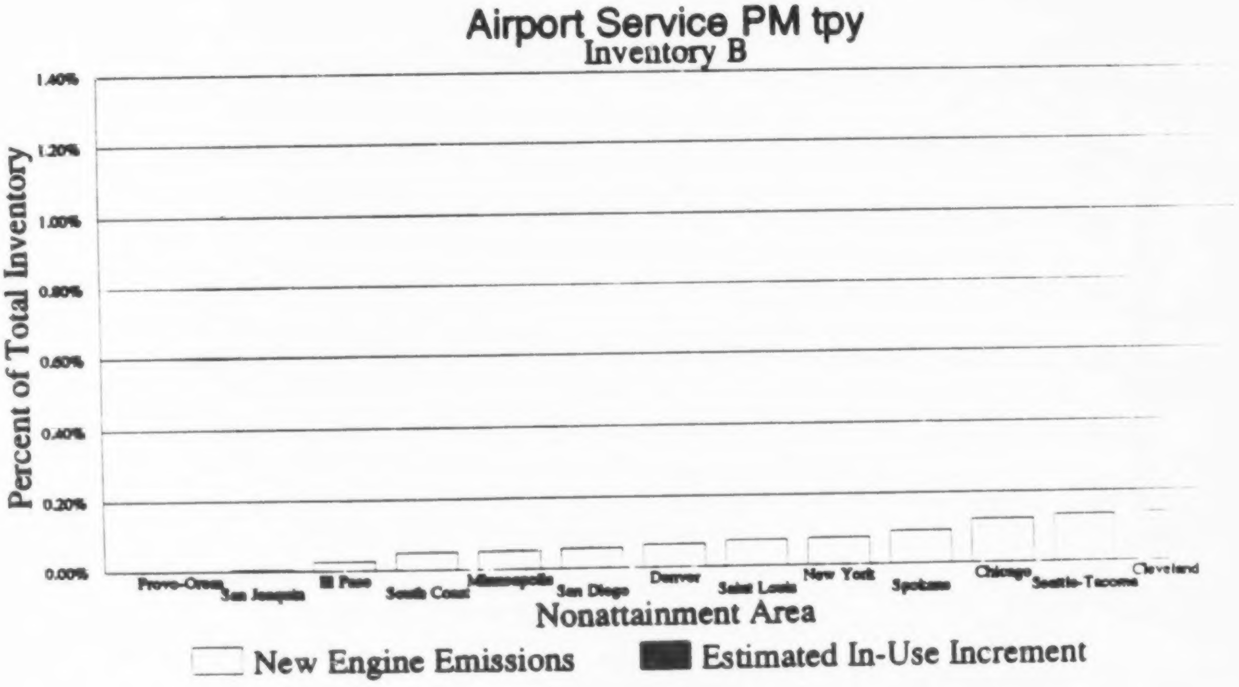


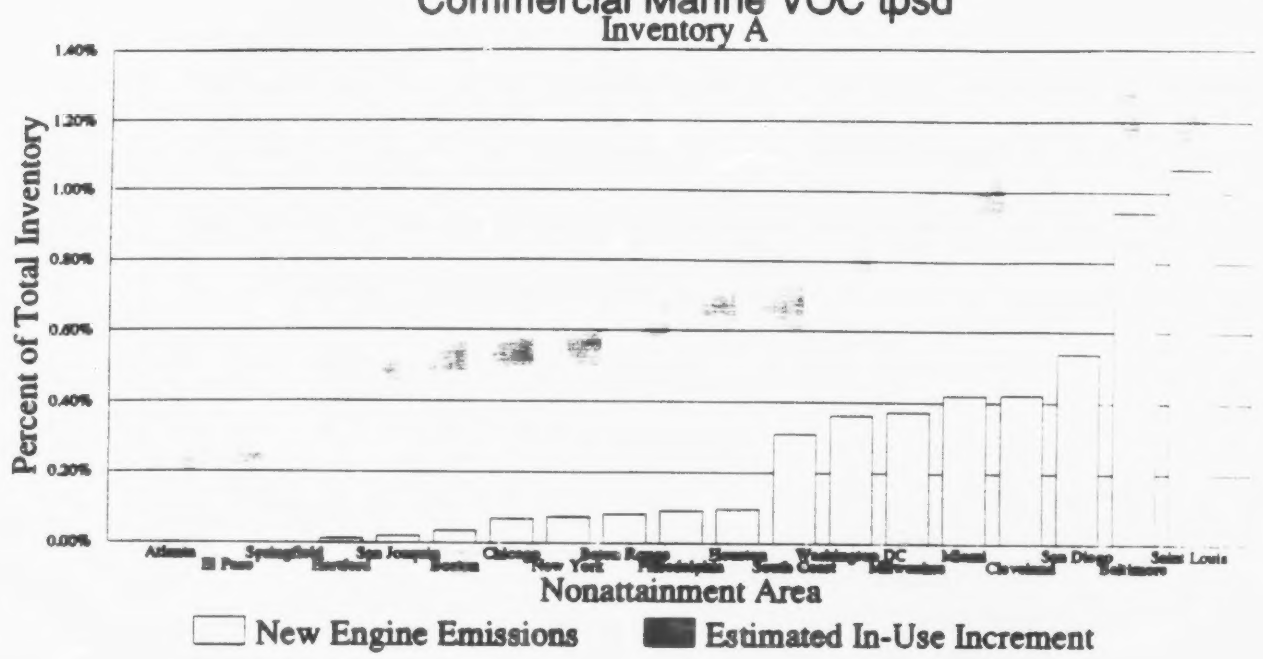
Airport Service NOx tpsd
Inventory B

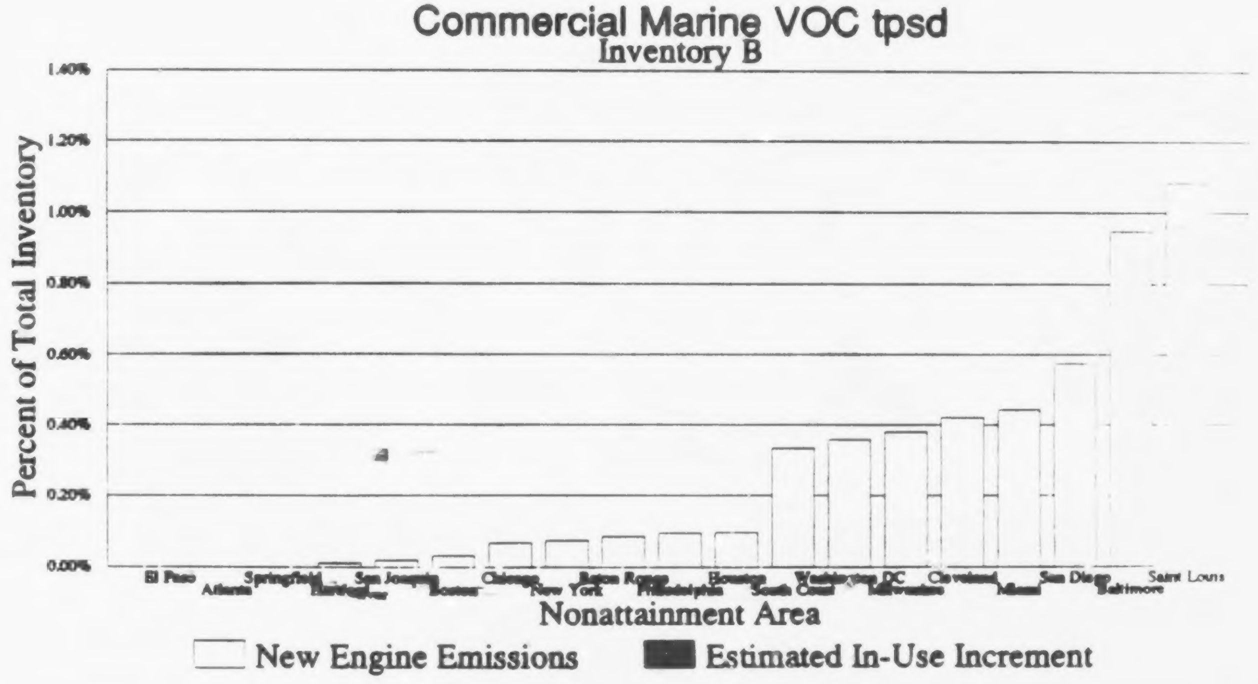

Airport Service CO tpwd
Inventory A
Percent of Total Inventory
1.40%
1.20%
1.00%
0.80%
0.60%
0.40%
0.20%
0.00%
Provo-Orem
San Joaquin
Spokane
New York
South Coast
Seattle-Tacoma
El Paso
Saint Louis
Denver
Minneapolis
Cleveland
San Diego
Washington DC
Boston
Baltimore
Hartford
Nonattainment Area
New Engine Emissions
Estimated In-Use Increment

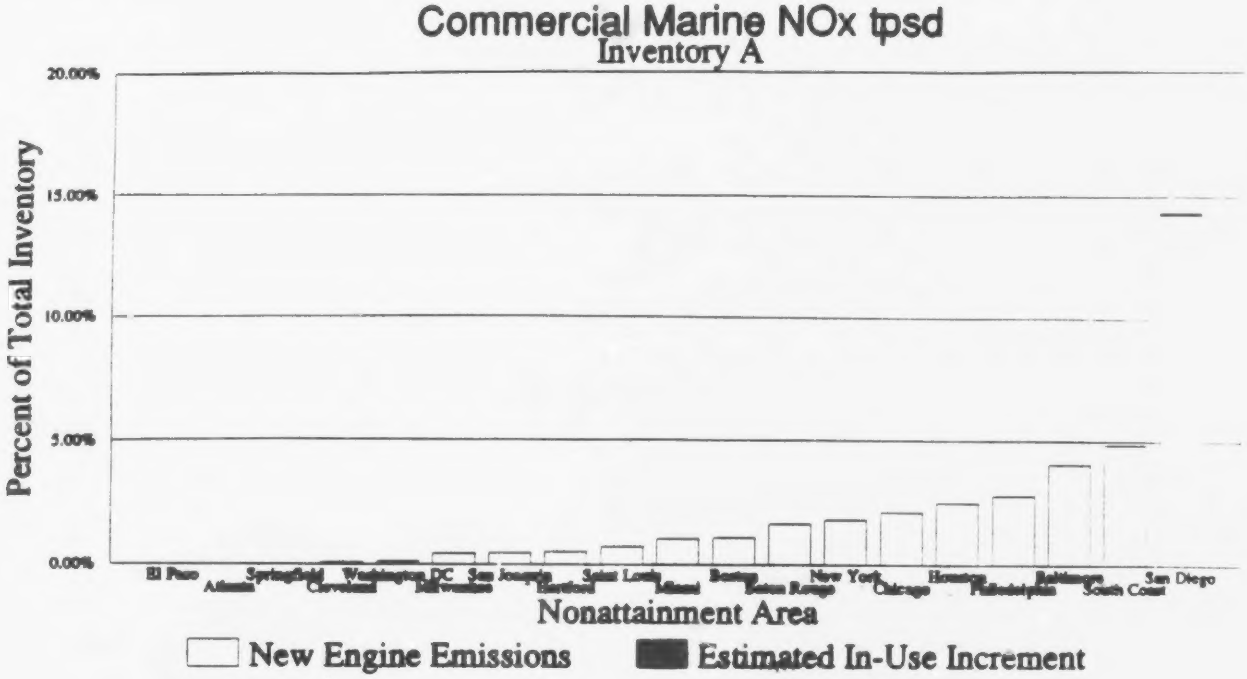

Airport Service CO tpwd
Inventory B
Percent of Total Inventory
1.40%
1.20%
1.00%
0.80%
0.60%
0.40%
0.20%
0.00%
Provo-Orem
San Joaquin
Spokane
New York
South Coast
Seattle-Tacoma
El Paso
Saint Louis
Denver
Minneapolis
Cleveland
San Diego
Washington DC
Boston
Baltimore
Hartford
Nonattainment Area
New Engine Emissions
Estimated In-Use Increment

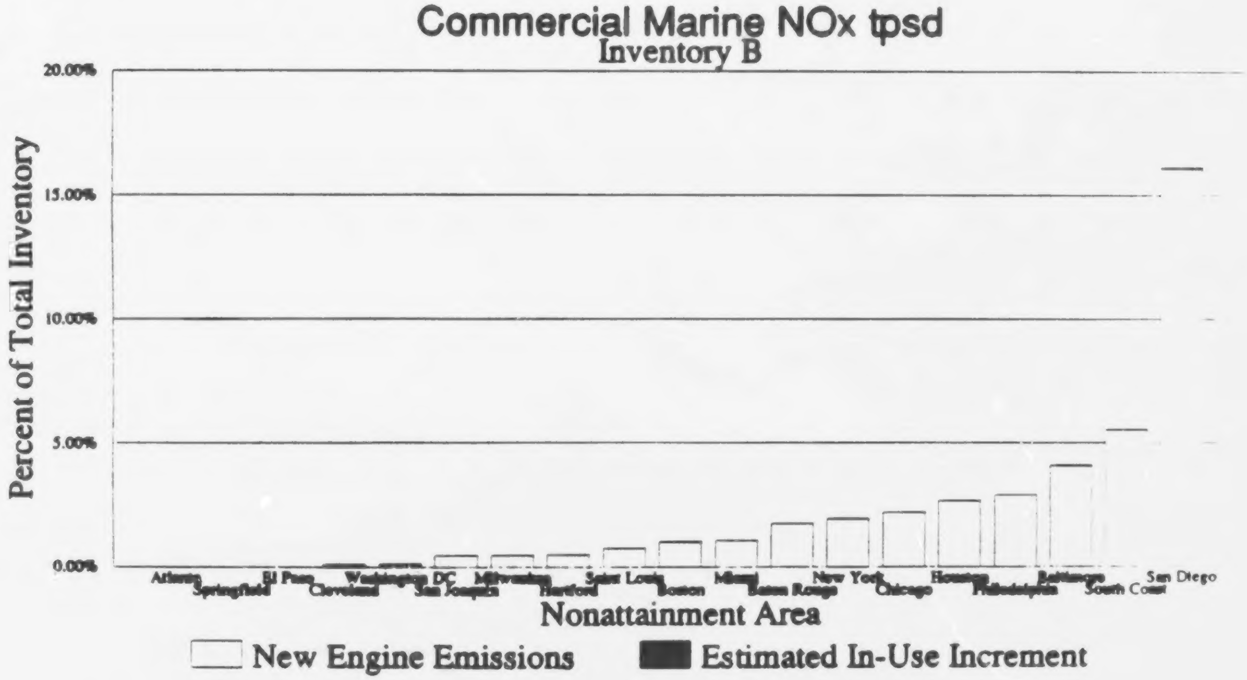

Airport Service PM tpy
Inventory A
1.40%
1.20%
1.00%
0.80%
0.60%
0.40%
0.20%
0.00%
Percent of Total Inventory
Provo-Orem
San Joaquin
El Paso
South Coast
Minneapolis
San Diego
Denver
Saint Louis
New York
Spokane
Chicago
Seattle-Tacoma
Cleveland
Nonattainment Area
New Engine Emissions
Estimated In-Use Increment

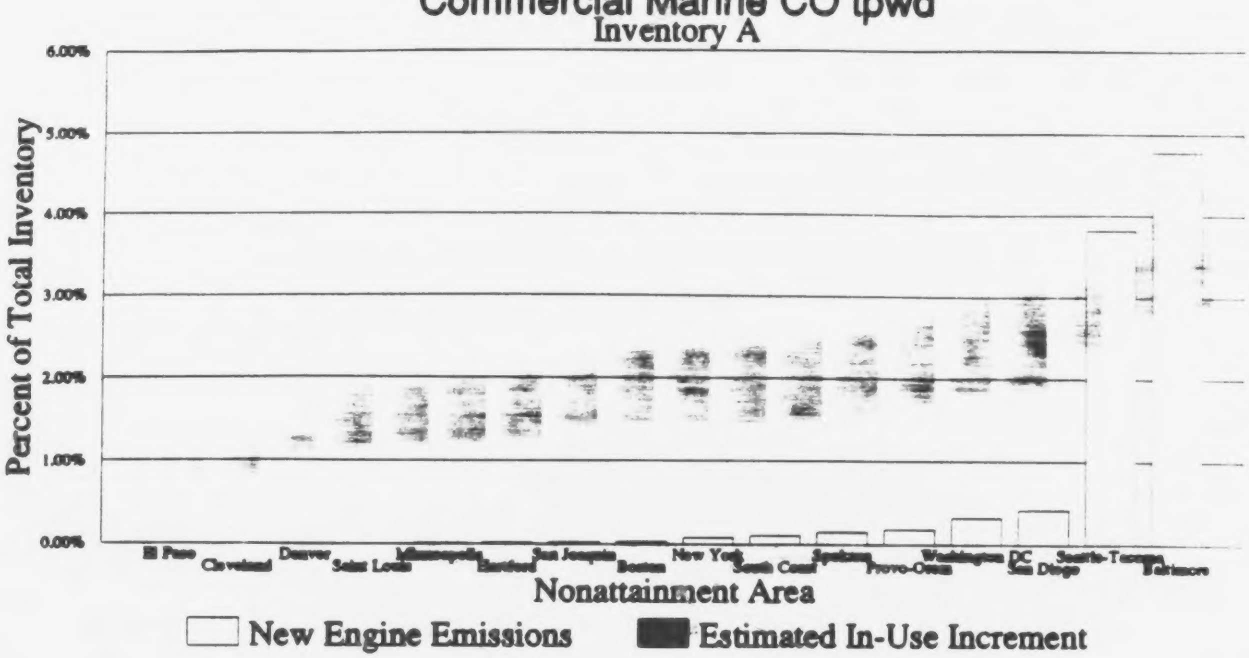

Airport Service PM tpy
Inventory B
1.40%
1.20%
1.00%
0.80%
0.60%
0.40%
0.20%
0.00%
Percent of Total Inventory
Provo-Orem
San Joaquin
El Paso
South Coast
Minneapolis
San Diego
Denver
Saint Louis
New York
Spokane
Chicago
Seattle-Tacoma
Cleveland
Nonattainment Area
New Engine Emissions
Estimated In-Use Increment

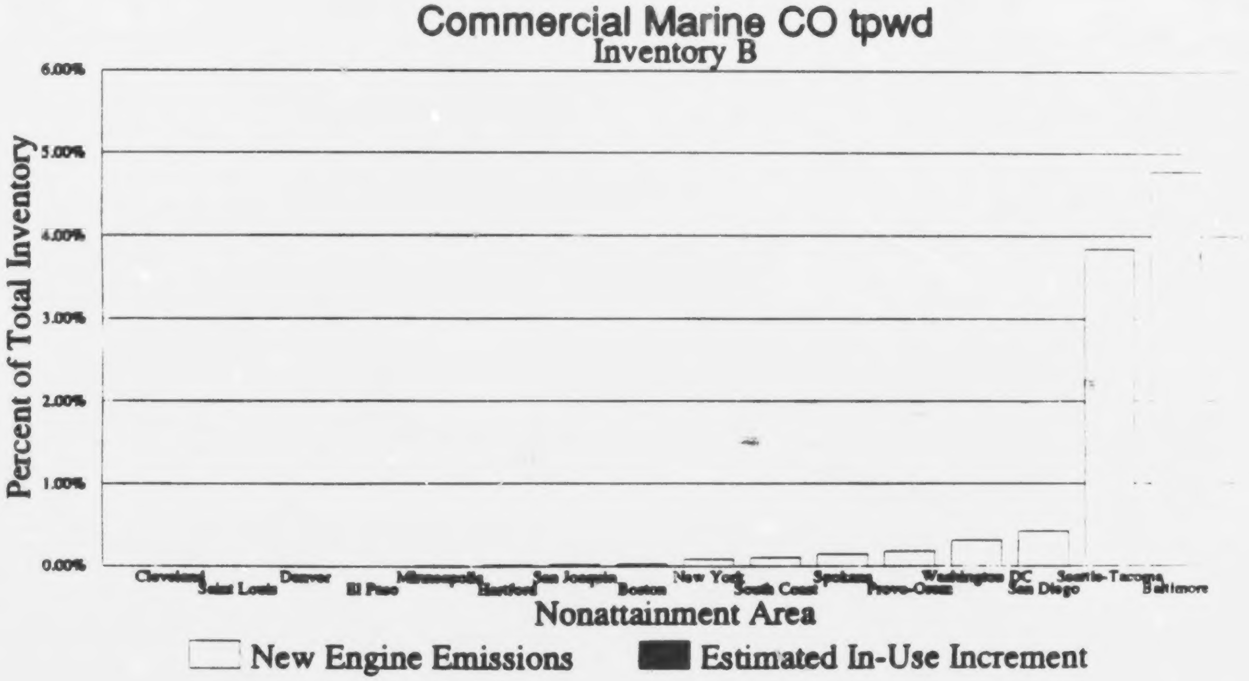

Commercial Marine VOC tpsd
Inventory A
Percent of Total Inventory
1.40%
1.20%
1.00%
0.80%
0.60%
0.40%
0.20%
0.00%
Atlanta
El Paso
Springfield
Hartford
San Joaquin
Boston
Chicago
New York
Baton Rouge
Philadelphia
Houston
South Coast
Washington DC
Milwaukee
Miami
Cleveland
San Diego
Baltimore
Saint Louis
Nonattainment Area
New Engine Emissions
Estimated In-Use Increment

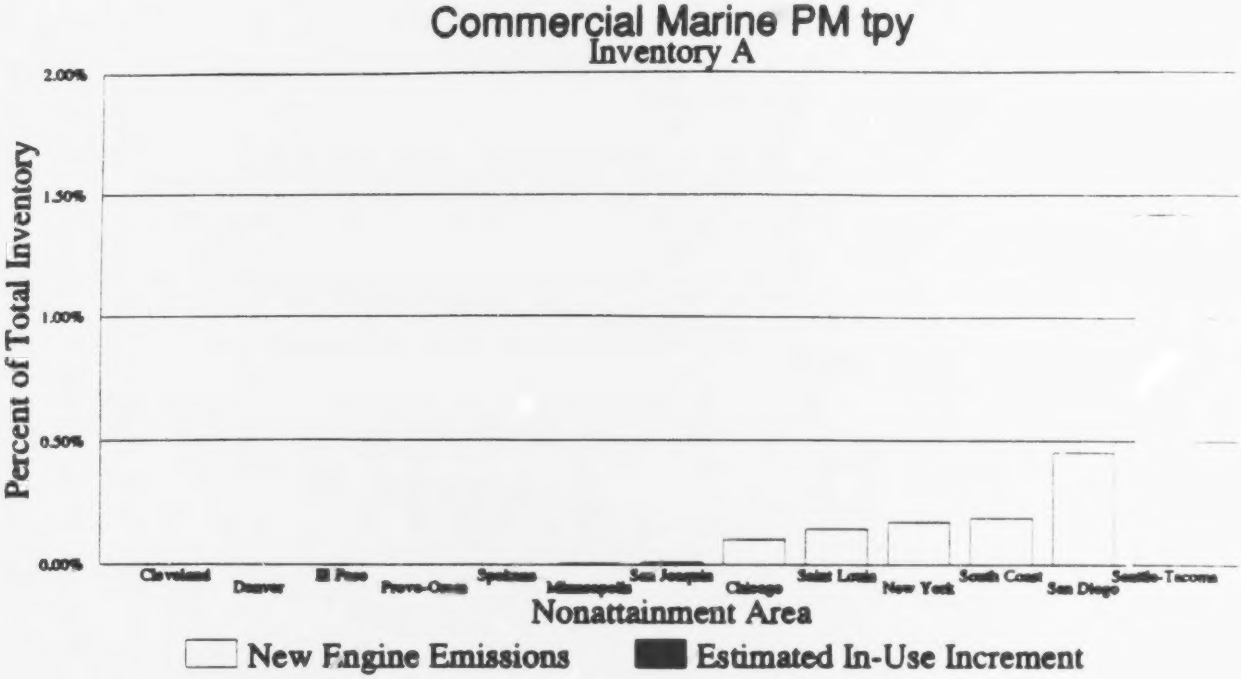

Commercial Marine VOC tpsd
Inventory B
Percent of Total Inventory
1.40%
1.20%
1.00%
0.80%
0.60%
0.40%
0.20%
0.00%
El Paso
Atlanta
Springfield
Hartford
San Joaquin
Boston
Chicago
New York
Baton Rouge
Philadelphia
Houston
South Coast
Washington DC
Milwaukee
Cleveland
Miami
San Diego
Baltimore
Saint Louis
Nonattainment Area
New Engine Emissions
Estimated In-Use Increment

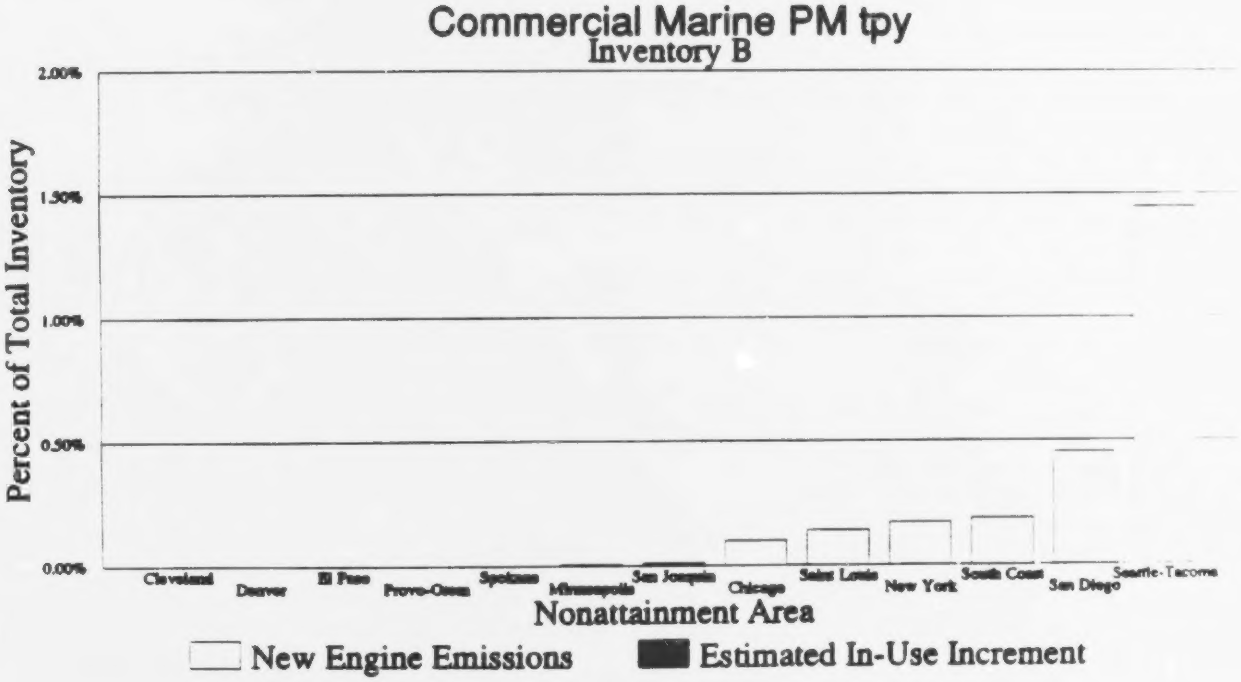

Commercial Marine NOx tpsd
Inventory A
Percent of Total Inventory
20.00%
15.00%
10.00%
5.00%
0.00%
El Paso
Atlanta
Springfield
Cleveland
Washington DC
Milwaukee
San Joaquin
Hartford
Saint Louis
Miami
Boston
Baton Rouge
New York
Chicago
Houston
Philadelphia
Baltimore
South Coast
San Diego
Nonattainment Area
New Engine Emissions
Estimated In-Use Increment

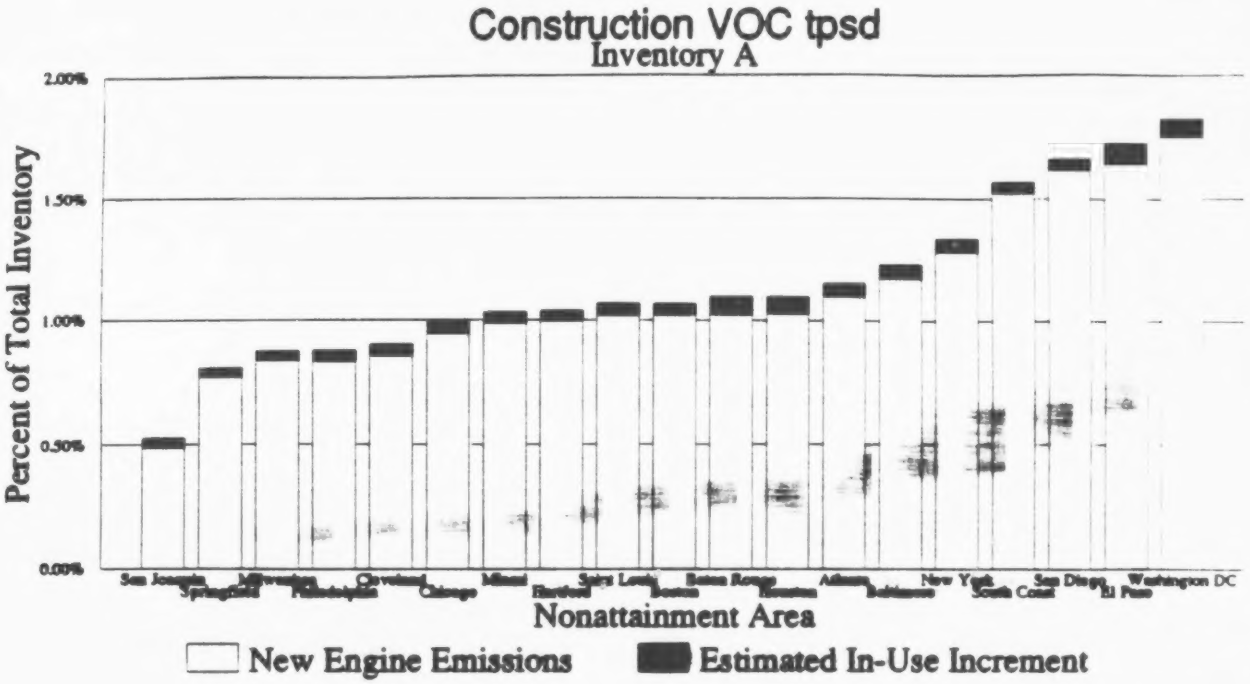

Commercial Marine NOx tpsd
Inventory B
Percent of Total Inventory
20.00%
15.00%
10.00%
5.00%
0.00%
Atlanta
Springfield
El Paso
Cleveland
Washington DC
San Joaquin
Milwaukee
Hartford
Saint Louis
Boston
Miami
Baton Rouge
New York
Chicago
Houston
Philadelphia
Baltimore
South Coast
San Diego
Nonattainment Area
New Engine Emissions
Estimated In-Use Increment


Commercial Marine CO tpwd
Inventory A
Percent of Total Inventory
6.00%
5.00%
4.00%
3.00%
2.00%
1.00%
0.00%
El Paso
Cleveland
Denver
Saint Louis
Minneapolis
Hartford
San Joaquin
Boston
New York
South Coast
Spokane
Provo-Orem
Washington DC
San Diego
Seattle-Tacoma
Baltimore
Nonattainment Area
New Engine Emissions
Estimated In-Use Increment

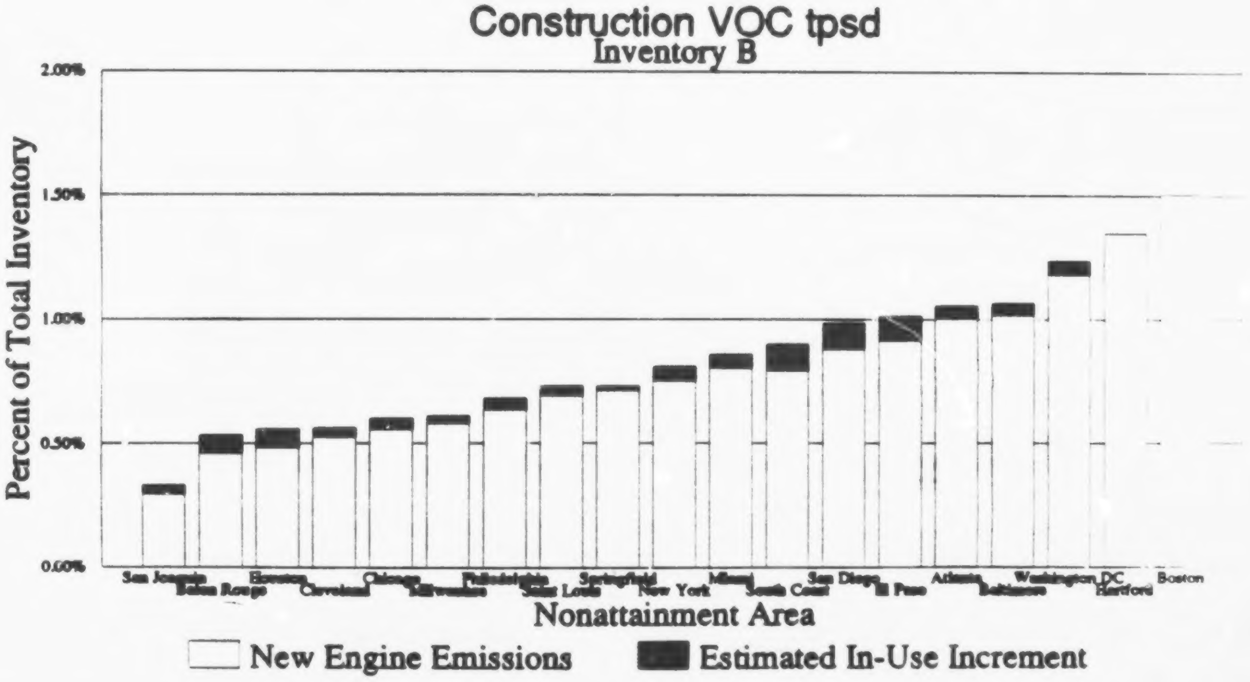

Commercial Marine CO tpwd
Inventory B
Percent of Total Inventory
6.00%
5.00%
4.00%
3.00%
2.00%
1.00%
0.00%
Cleveland
Saint Louis
Denver
El Paso
Minneapolis
Hartford
San Joaquin
Boston
New York
South Coast
Spokane
Provo-Orem
Washington DC
San Diego
Seattle-Tacoma
Baltimore
Nonattainment Area
New Engine Emissions
Estimated In-Use Increment

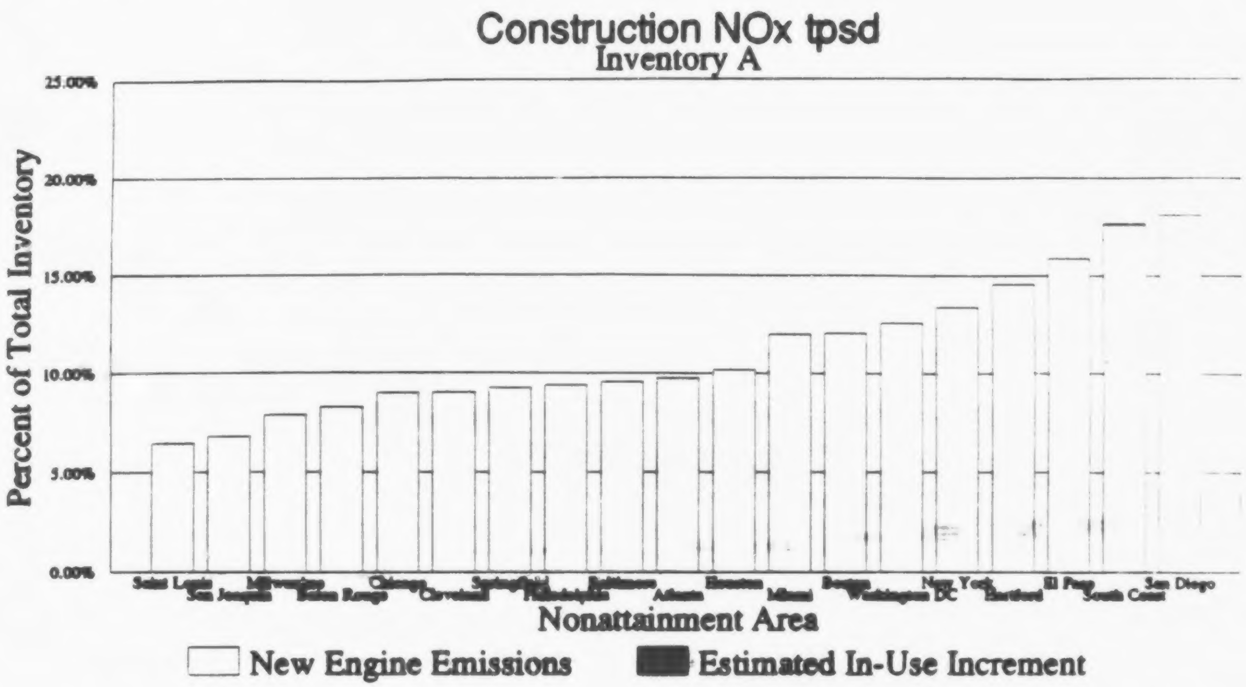

Commercial Marine PM tpy
Inventory A
2.00%
1.50%
1.00%
0.50%
0.00%
Percent of Total Inventory
Cleveland
Denver
El Paso
Provo-Orem
Spokane
Minneapolis
San Joaquin
Chicago
Saint Louis
New York
South Coast
San Diego
Seattle-Tacoma
Nonattainment Area
New Engine Emissions
Estimated In-Use Increment


Commercial Marine PM tpy
Inventory B
2.00%
1.50%
1.00%
0.50%
0.00%
Percent of Total Inventory
Cleveland
Denver
El Paso
Provo-Orem
Spokane
Minneapolis
San Joaquin
Chicago
Saint Louis
New York
South Coast
San Diego
Seattle-Tacoma
Nonattainment Area
New Engine Emissions
Estimated In-Use Increment

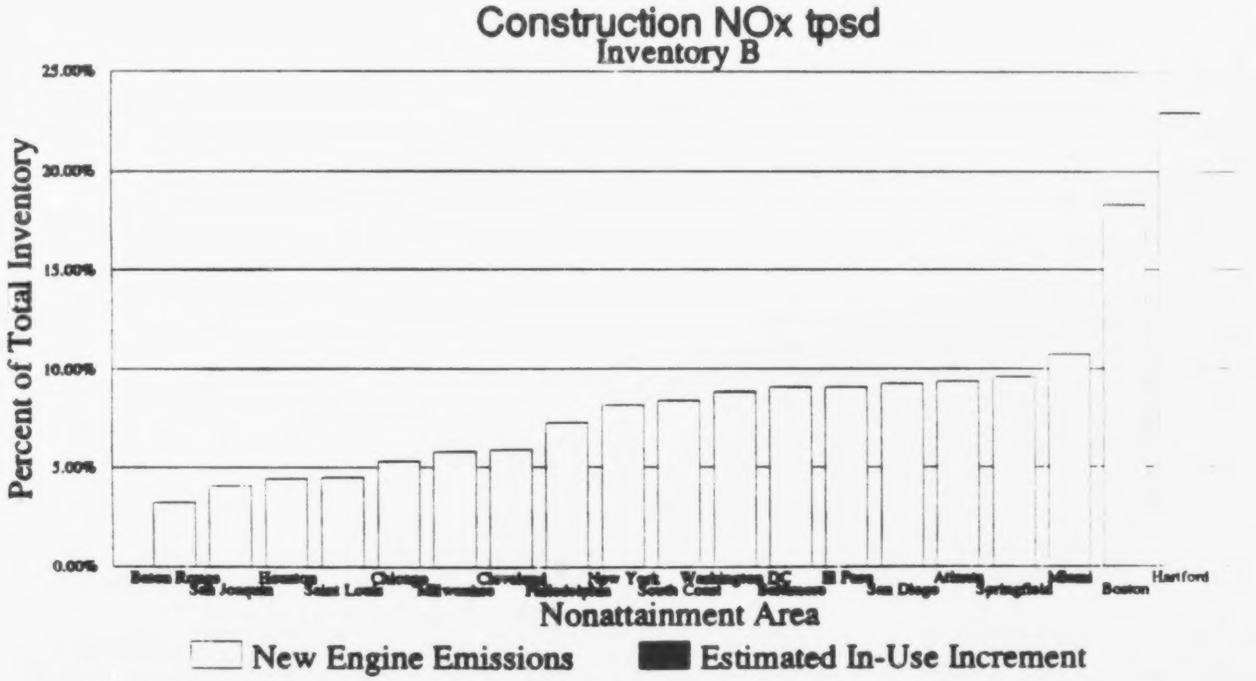

Construction VOC tpsd
Inventory A
2.00%
1.50%
1.00%
0.50%
0.00%
Percent of Total Inventory
San Joaquin
Springfield
Milwaukee
Philadelphia
Cleveland
Chicago
Miami
Hartford
Saint Louis
Boston
Baton Rouge
Houston
Atlanta
Baltimore
New York
South Coast
San Diego
El Paso
Washington DC
Nonattainment Area
New Engine Emissions
Estimated In-Use Increment

6

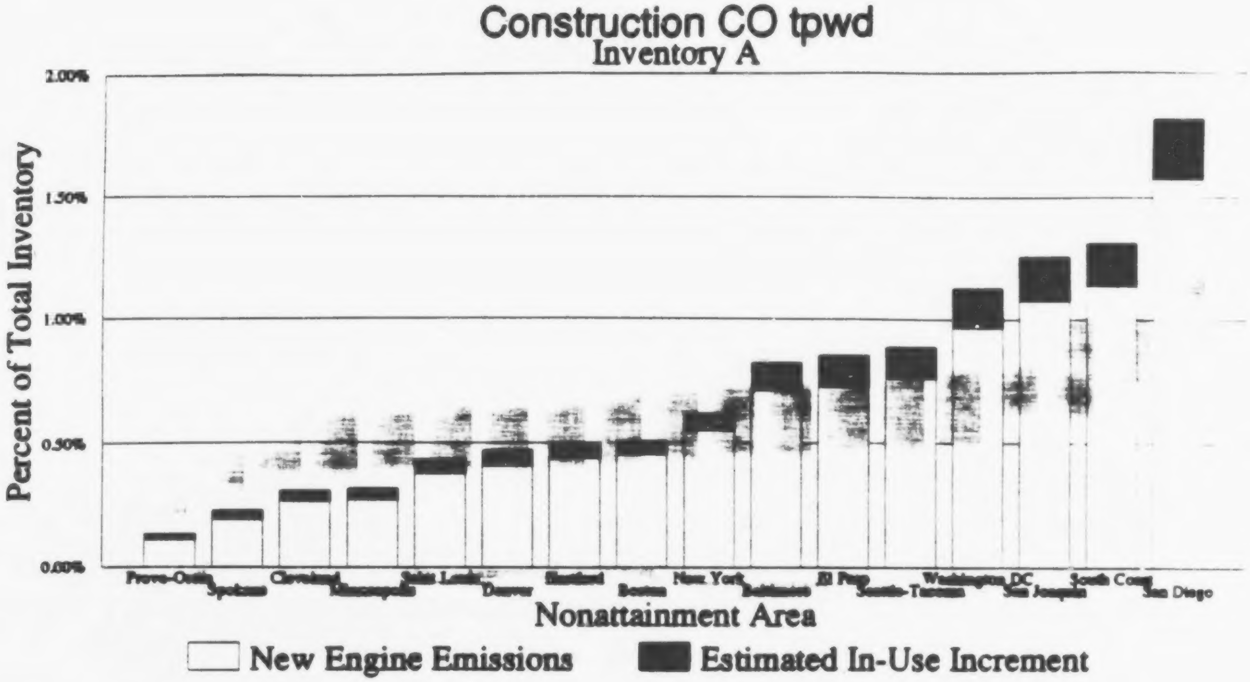

Construction VOC tpsd
Inventory B
2.00%
1.50%
1.00%
0.50%
0.00%
Percent of Total Inventory
San Joaquin
Baton Rouge
Houston
Cleveland
Chicago
Milwaukee
Philadelphia
Saint Louis
Springfield
New York
Miami
South Coast
San Diego
El Paso
Atlanta
Baltimore
Washington DC
Hartford
Boston
Nonattainment Area
New Engine Emissions
Estimated In-Use Increment

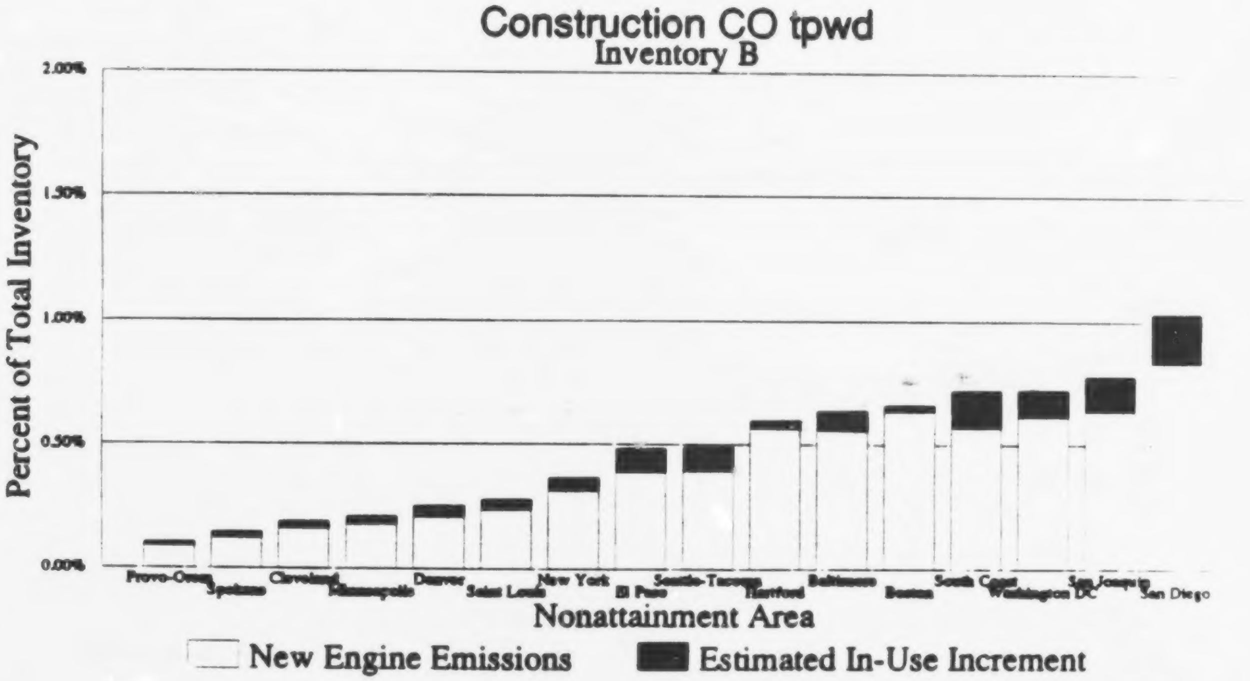


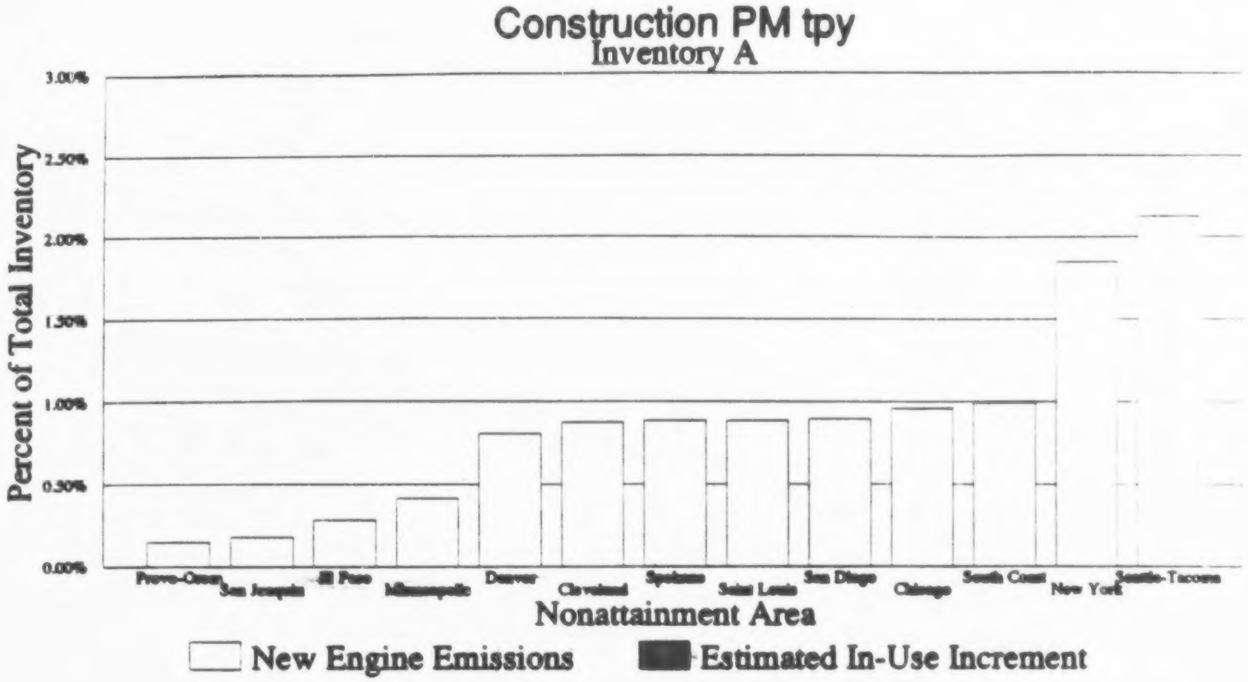
Construction NOx tpsd
Inventory A

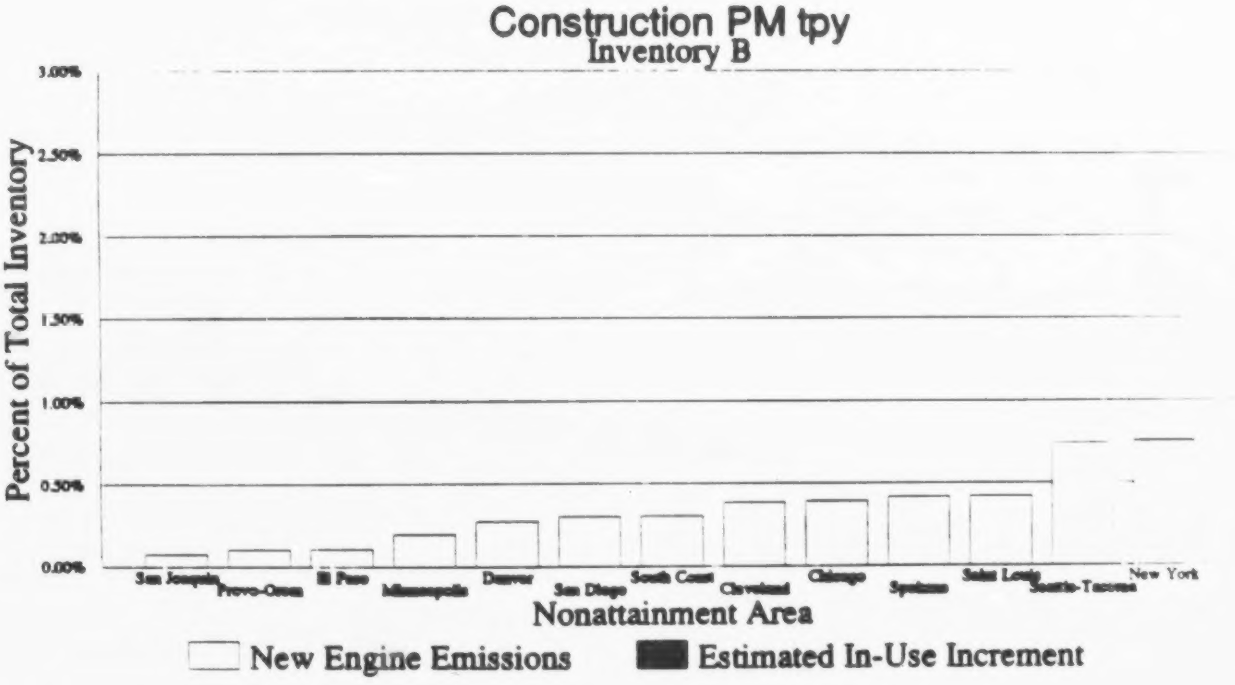


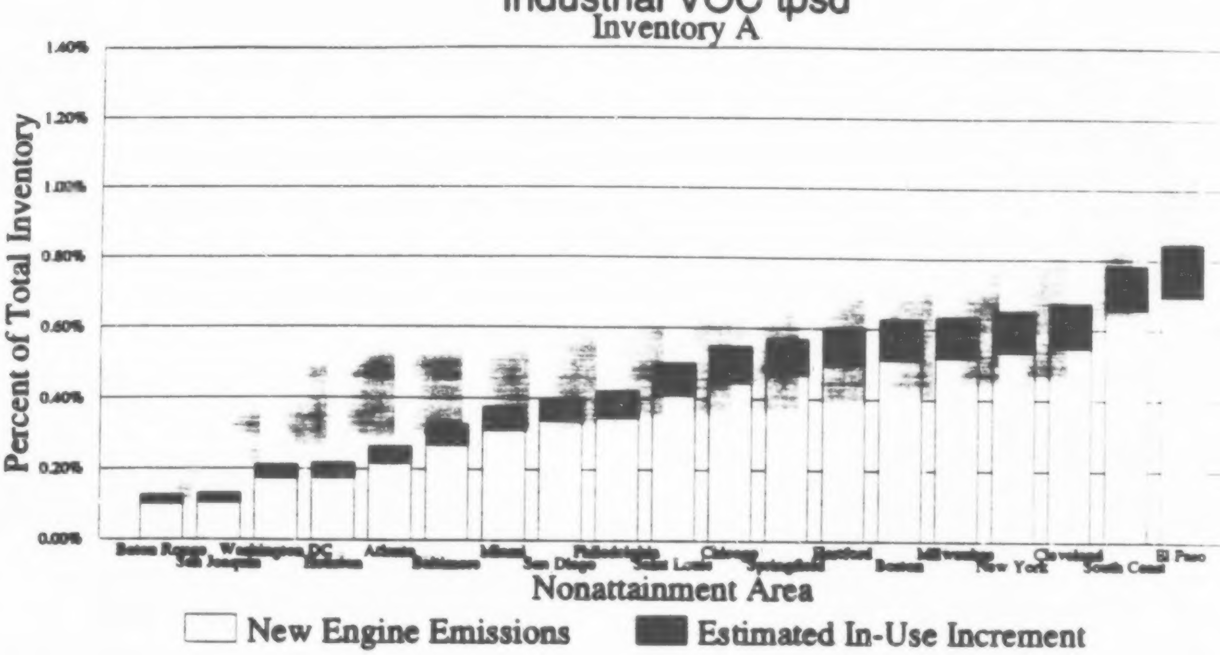
Construction NOx tpsd
Inventory B

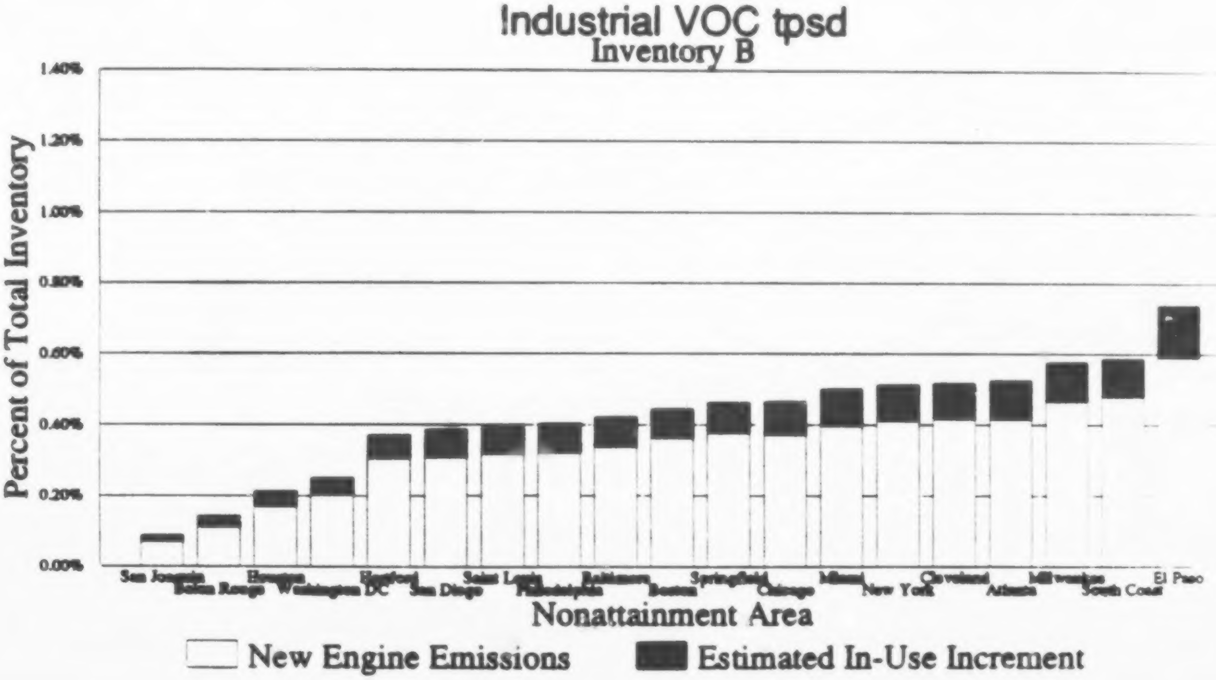

Construction CO tpwd
Inventory A
Percent of Total Inventory
2.00%
1.50%
1.00%
0.50%
0.00%
Provo-Orem
Spokane
Cleveland
Minneapolis
Saint Louis
Denver
Hartford
Boston
New York
Baltimore
El Paso
Seattle-Tacoma
Washington DC
San Joaquin
South Coast
San Diego
Nonattainment Area
New Engine Emissions
Estimated In-Use Increment

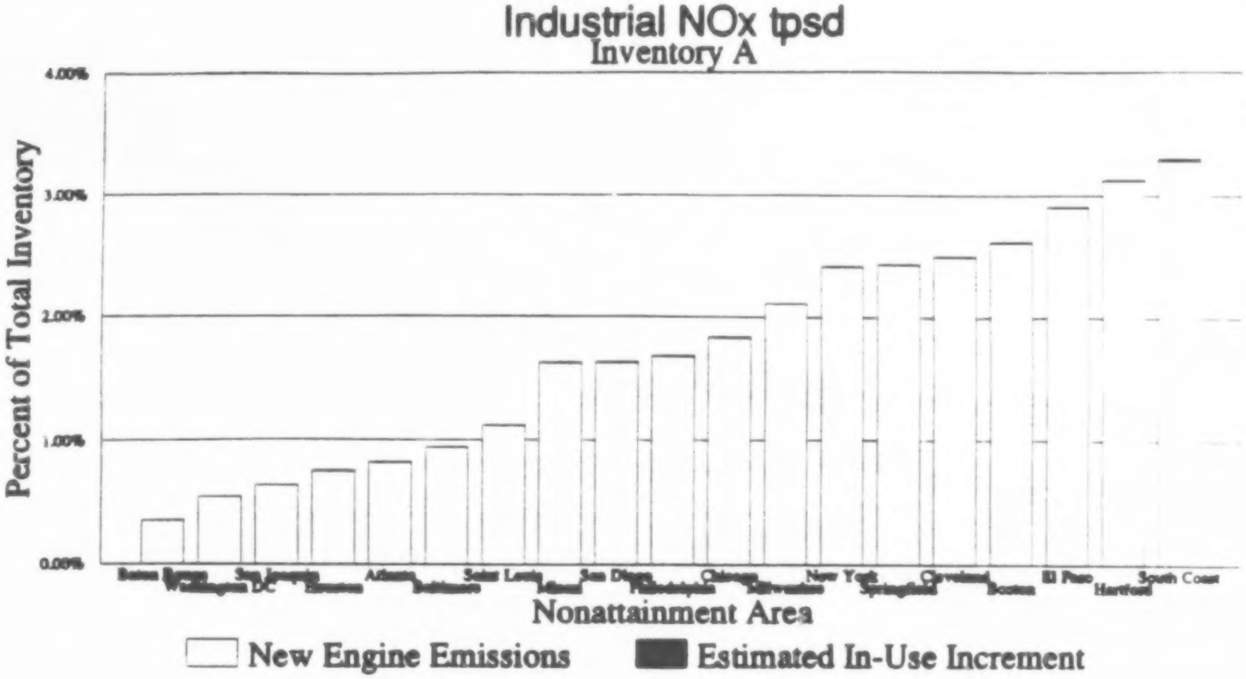

Construction CO tpwd
Inventory B
Percent of Total Inventory
2.00%
1.50%
1.00%
0.50%
0.00%
Provo-Orem
Spokane
Cleveland
Minneapolis
Denver
Saint Louis
New York
El Paso
Seattle-Tacoma
Hartford
Baltimore
Boston
South Coast
Washington DC
San Joaquin
San Diego
Nonattainment Area
New Engine Emissions
Estimated In-Use Increment


Construction PM tpy
Inventory A
Percent of Total Inventory
3.00%
2.50%
2.00%
1.50%
1.00%
0.50%
0.00%
Provo-Orem
San Joaquin
El Paso
Minneapolis
Denver
Cleveland
Spokane
Saint Louis
San Diego
Chicago
South Coast
New York
Seattle-Tacoma
Nonattainment Area
New Engine Emissions
Estimated In-Use Increment

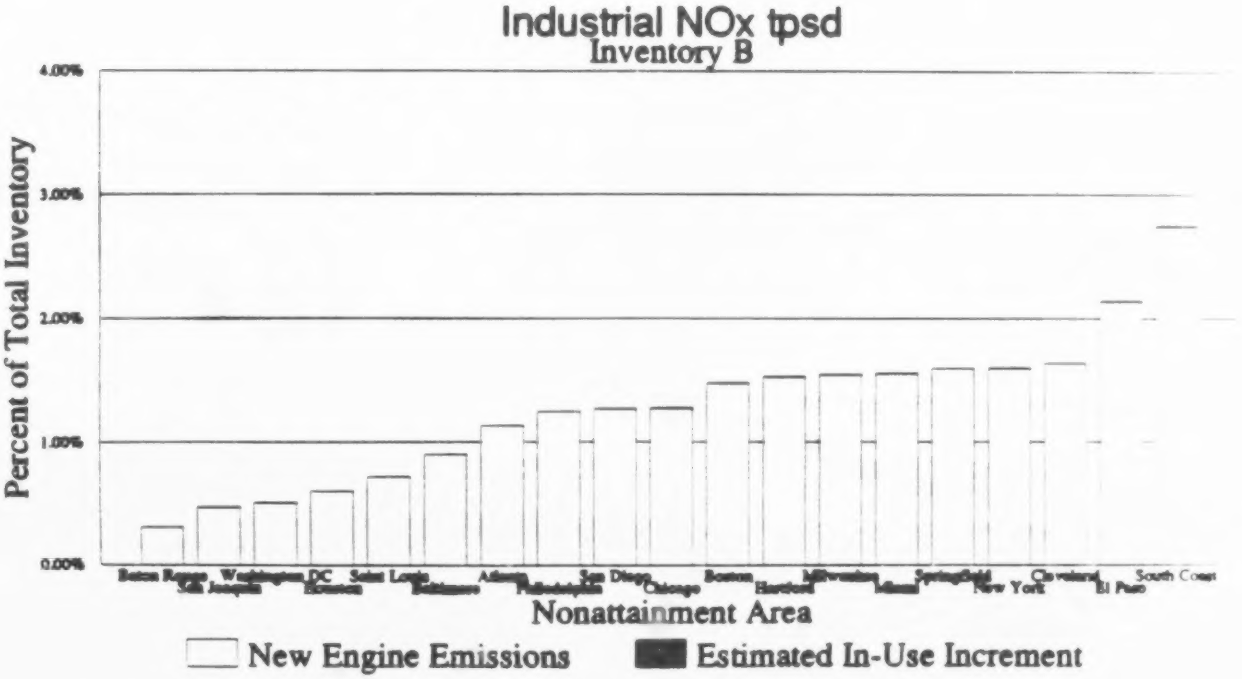

Construction PM tpy
Inventory B
Percent of Total Inventory
3.00%
2.50%
2.00%
1.50%
1.00%
0.50%
0.00%
San Joaquin
Provo-Orem
El Paso
Minneapolis
Denver
San Diego
South Coast
Cleveland
Chicago
Spokane
Saint Louis
Seattle-Tacoma
New York
Nonattainment Area
New Engine Emissions
Estimated In-Use Increment


Industrial VOC tpsd
Inventory A
Percent of Total Inventory
1.40%
1.20%
1.00%
0.80%
0.60%
0.40%
0.20%
0.00%
Baton Rouge
San Joaquin
Washington DC
Houston
Atlanta
Baltimore
Miami
San Diego
Philadelphia
Saint Louis
Chicago
Springfield
Hartford
Boston
Milwaukee
New York
Cleveland
South Coast
El Paso
Nonattainment Area
New Engine Emissions
Estimated In-Use Increment

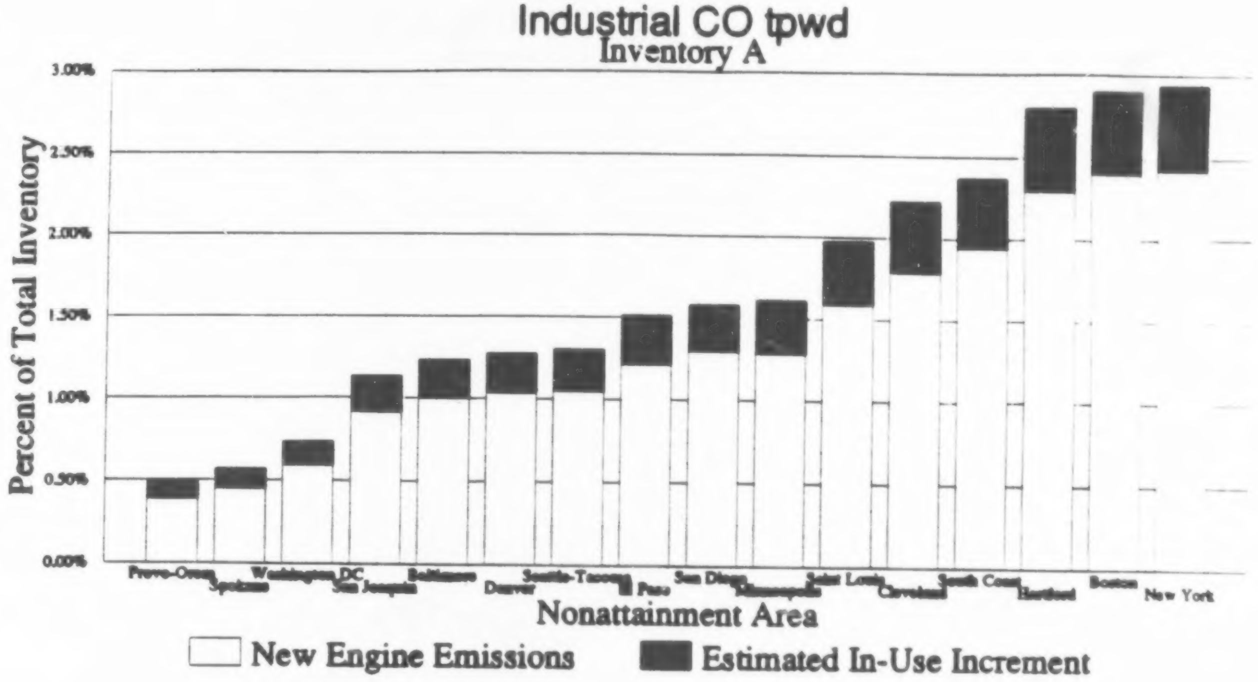

Industrial VOC tpsd
Inventory B
Percent of Total Inventory
1.40%
1.20%
1.00%
0.80%
0.60%
0.40%
0.20%
0.00%
San Joaquin
Baton Rouge
Houston
Washington DC
Hartford
San Diego
Saint Louis
Philadelphia
Baltimore
Boston
Springfield
Chicago
Miami
New York
Cleveland
Atlanta
Milwaukee
South Coast
El Paso
Nonattainment Area
New Engine Emissions
Estimated In-Use Increment



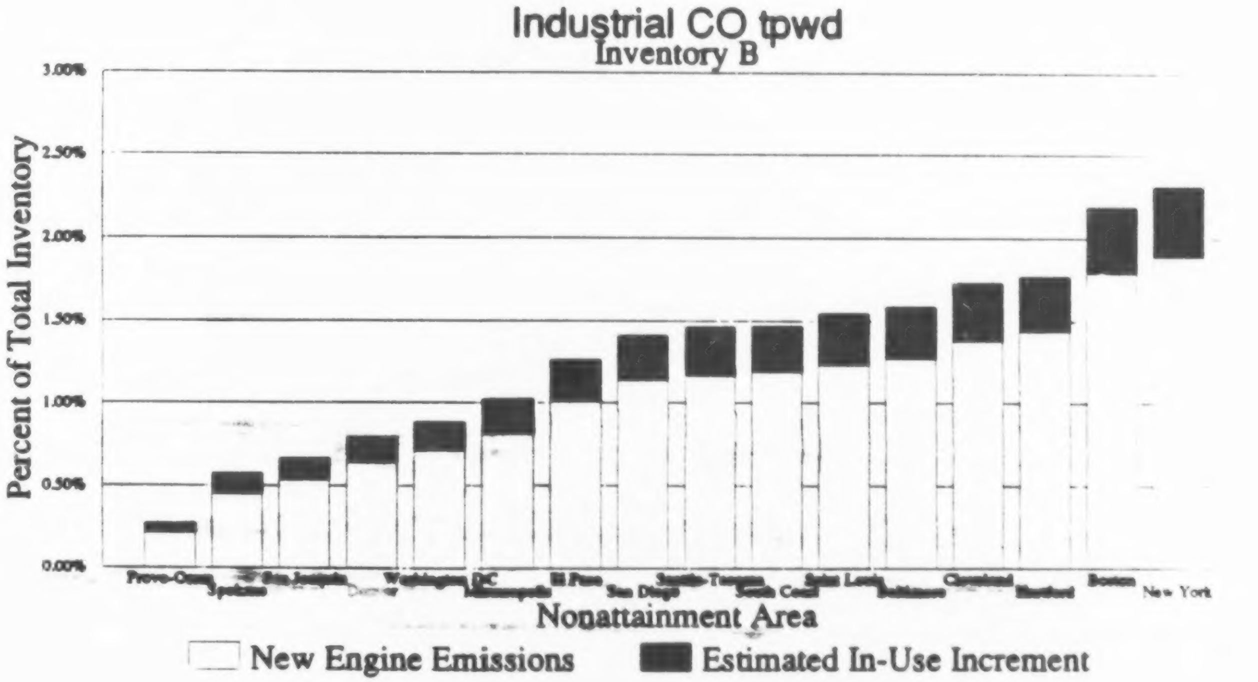
Industrial NOx tpsd
Inventory A



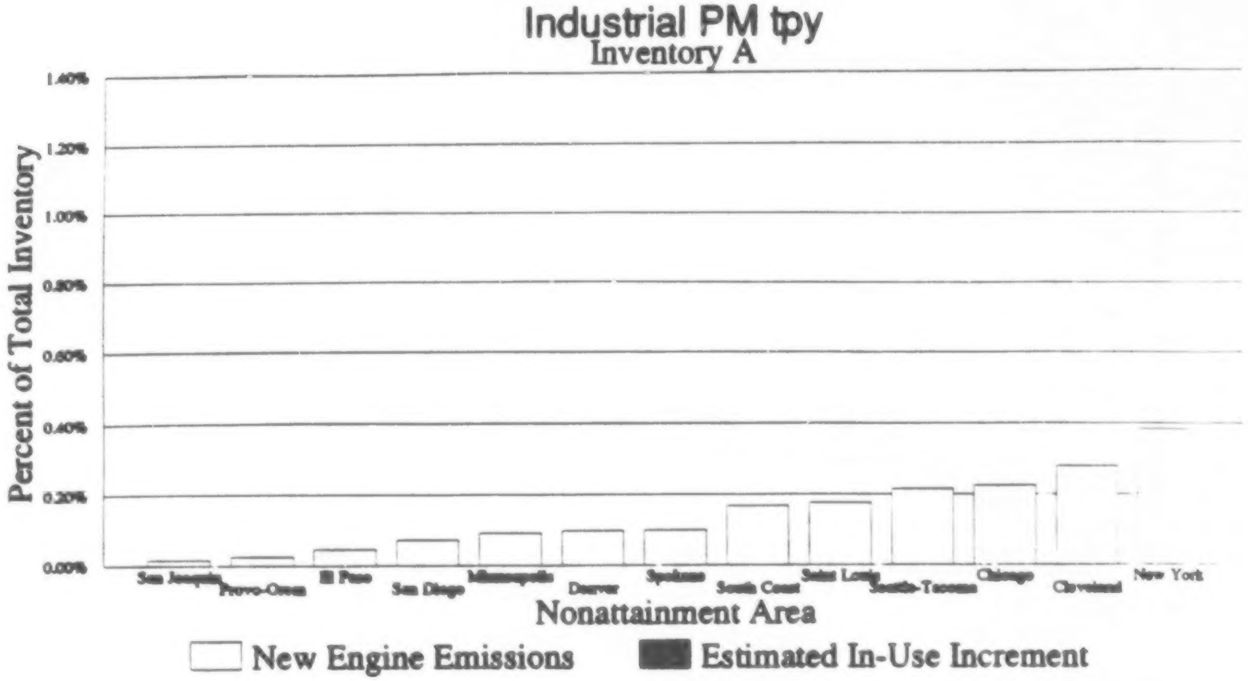
Industrial NOx tpsd
Inventory B

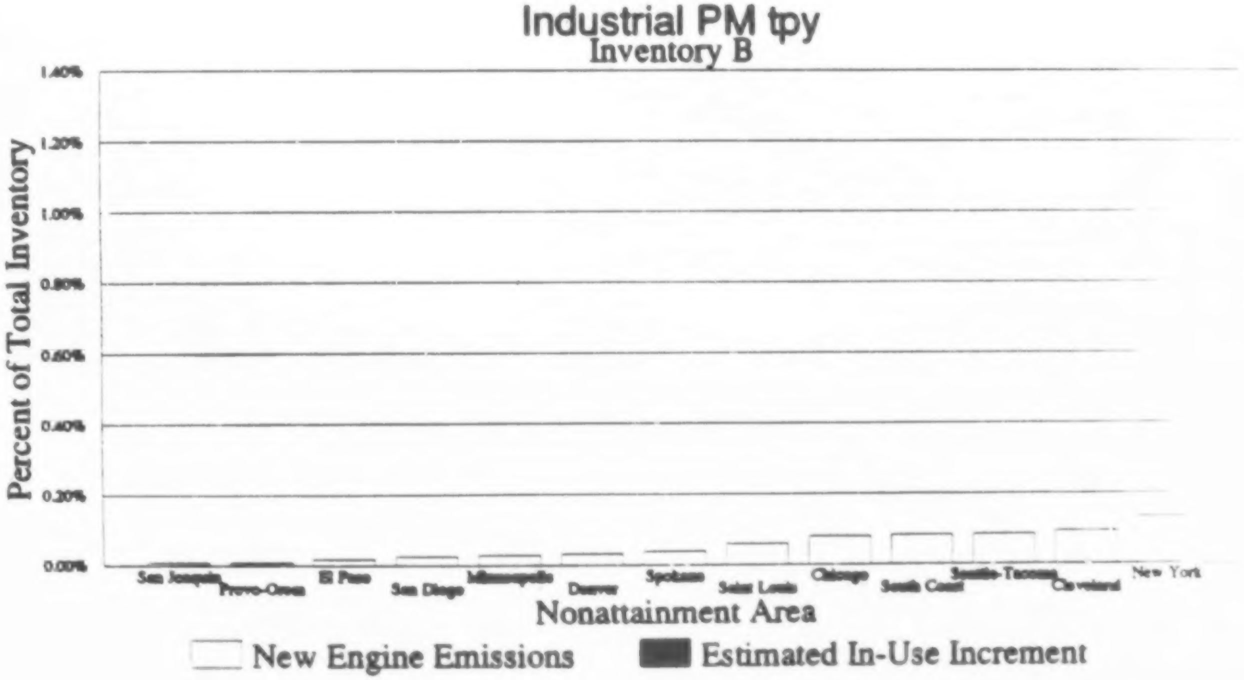


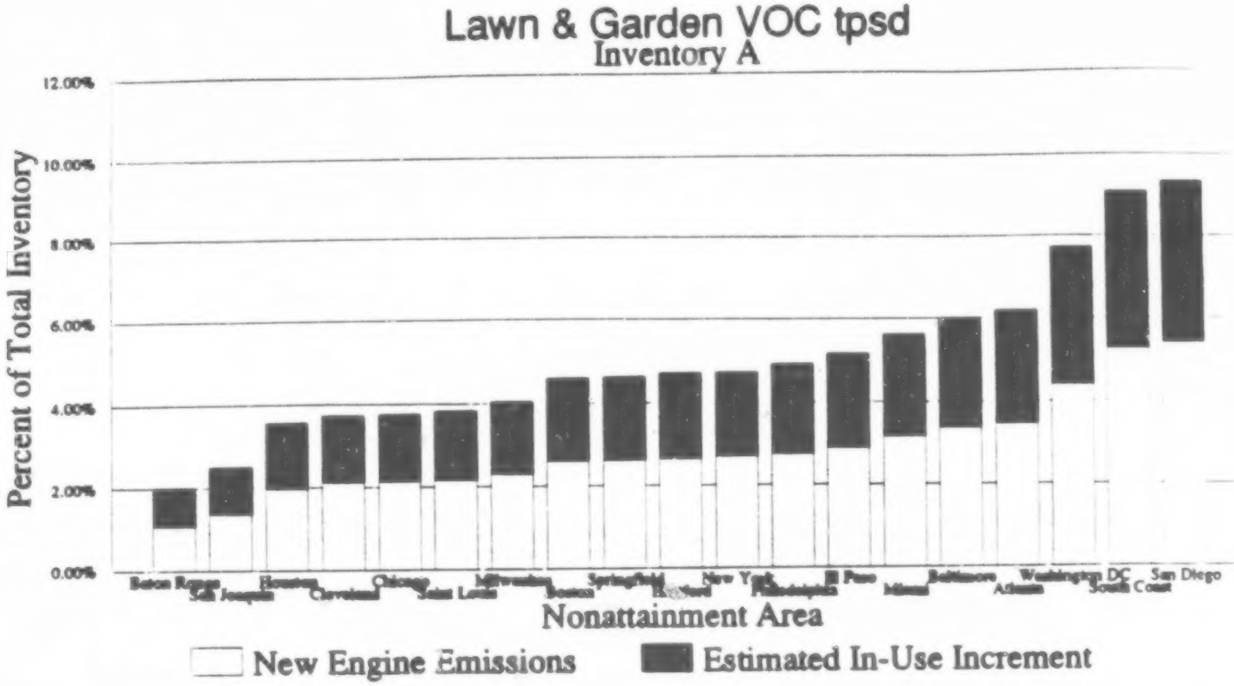
Industrial CO tpwd
Inventory A

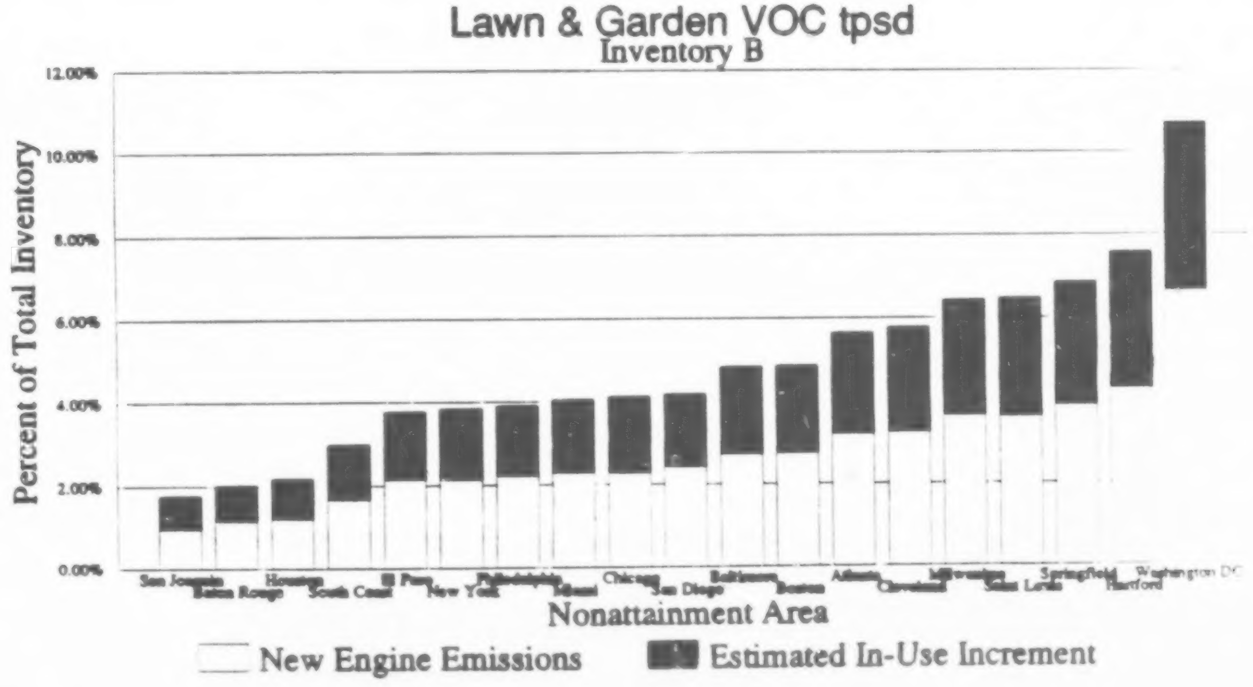


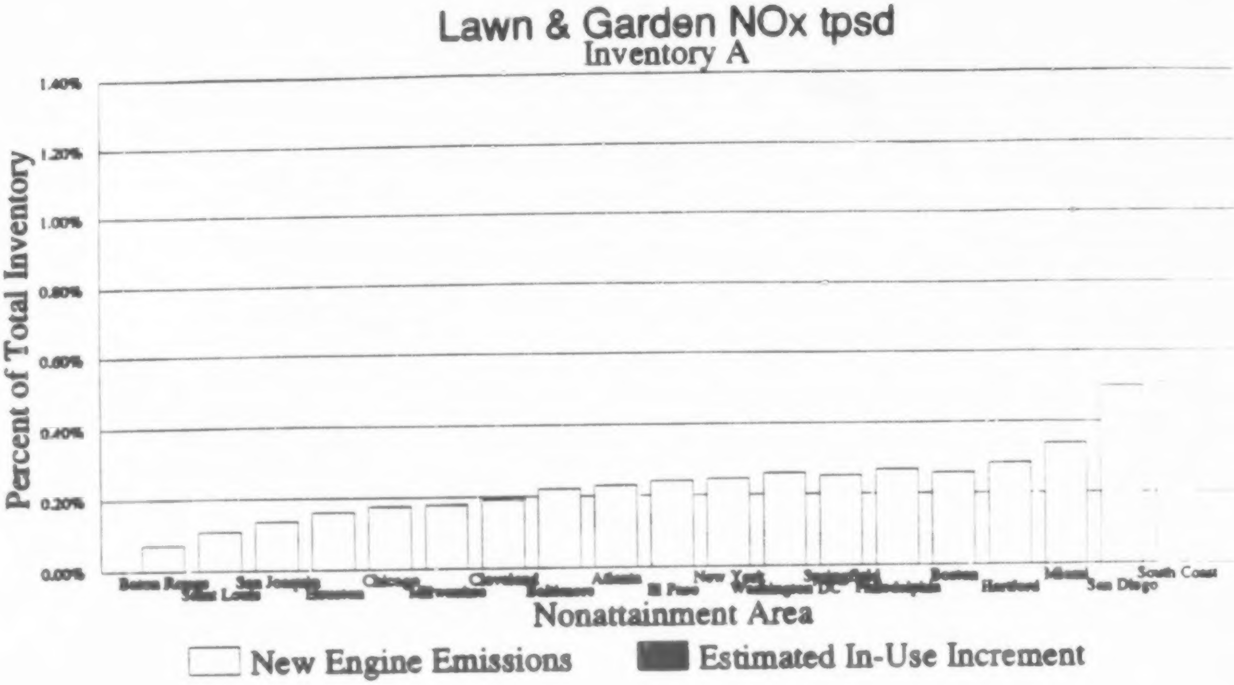
Industrial CO tpwd
Inventory B

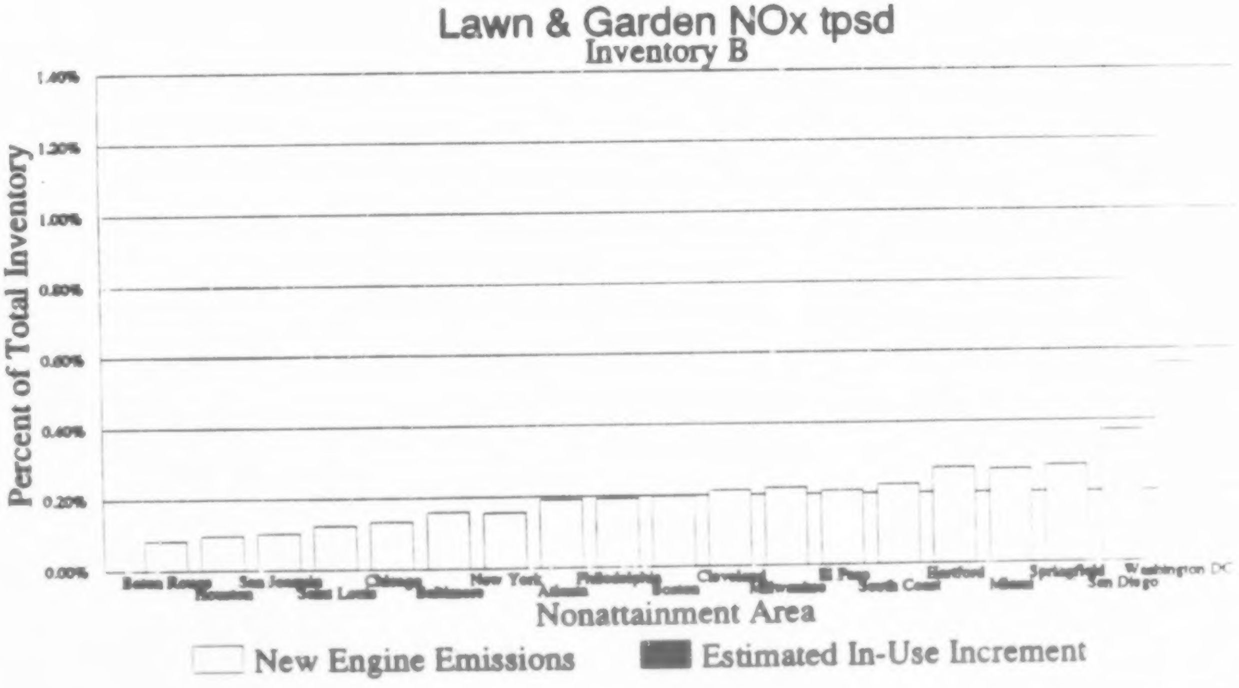

Industrial PM tpy
Inventory A
Percent of Total Inventory
1.40%
1.20%
1.00%
0.80%
0.60%
0.40%
0.20%
0.00%
San Joaquin
Provo-Orem
El Paso
San Diego
Minneapolis
Denver
Spokane
South Coast
Saint Louis
Seattle-Tacoma
Chicago
Cleveland
New York
Nonattainment Area
New Engine Emissions
Estimated In-Use Increment

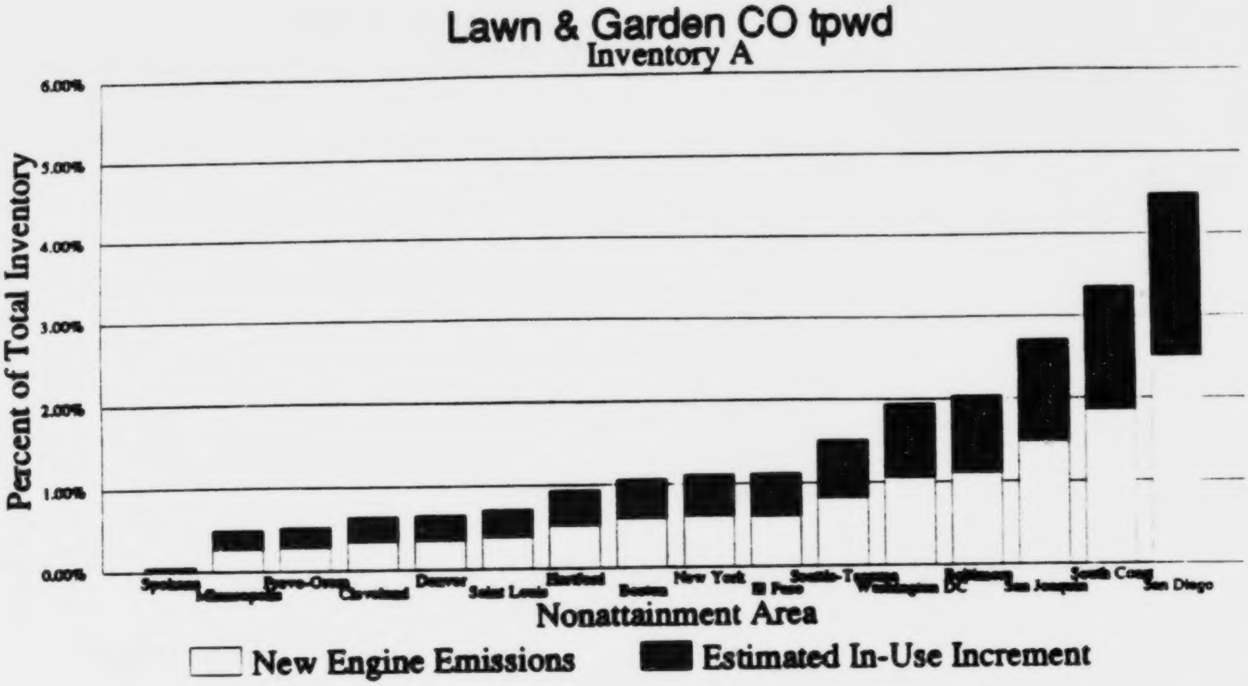

Industrial PM tpy
Inventory B
Percent of Total Inventory
1.40%
1.20%
1.00%
0.80%
0.60%
0.40%
0.20%
0.00%
San Joaquin
Provo-Orem
El Paso
San Diego
Minneapolis
Denver
Spokane
Saint Louis
Chicago
South Coast
Seattle-Tacoma
Cleveland
New York
Nonattainment Area
New Engine Emissions
Estimated In-Use Increment

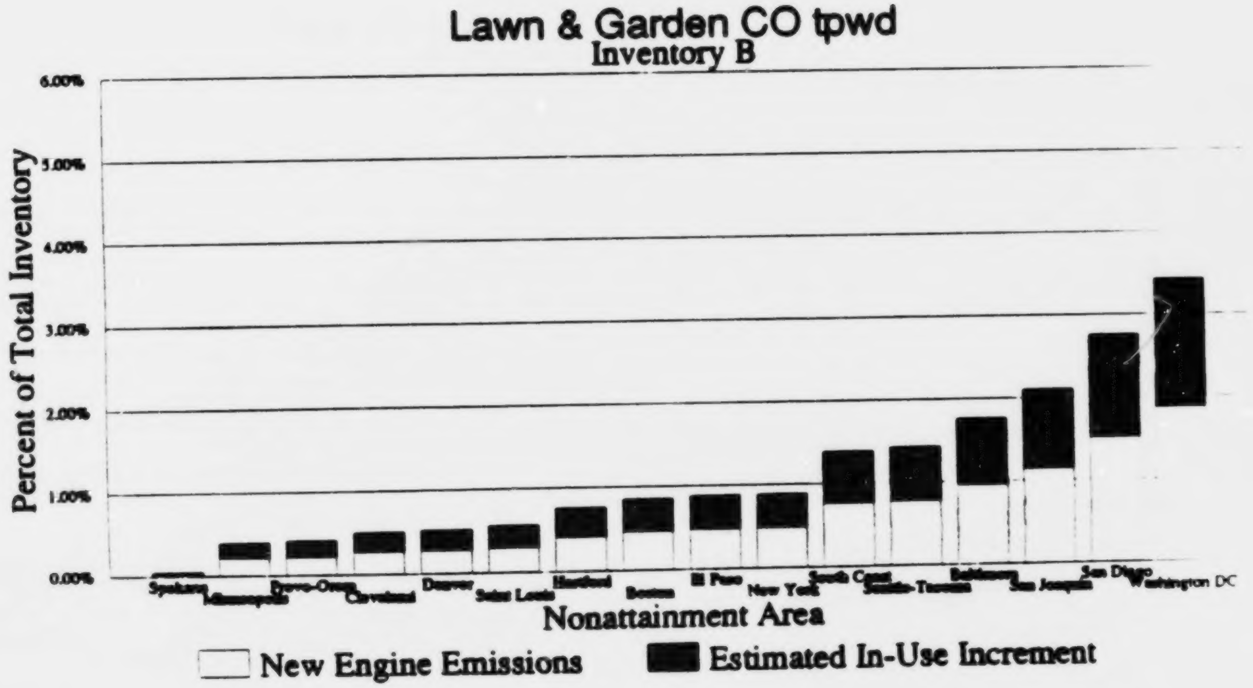

Lawn & Garden VOC tpsd
Inventory A
Percent of Total Inventory
12.00%
10.00%
8.00%
6.00%
4.00%
2.00%
0.00%
Baton Rouge
San Joaquin
Houston
Cleveland
Chicago
Saint Louis
Milwaukee
Boston
Springfield
Hartford
New York
Philadelphia
El Paso
Miami
Baltimore
Atlanta
Washington DC
South Coast
San Diego
Nonattainment Area
New Engine Emissions
Estimated In-Use Increment

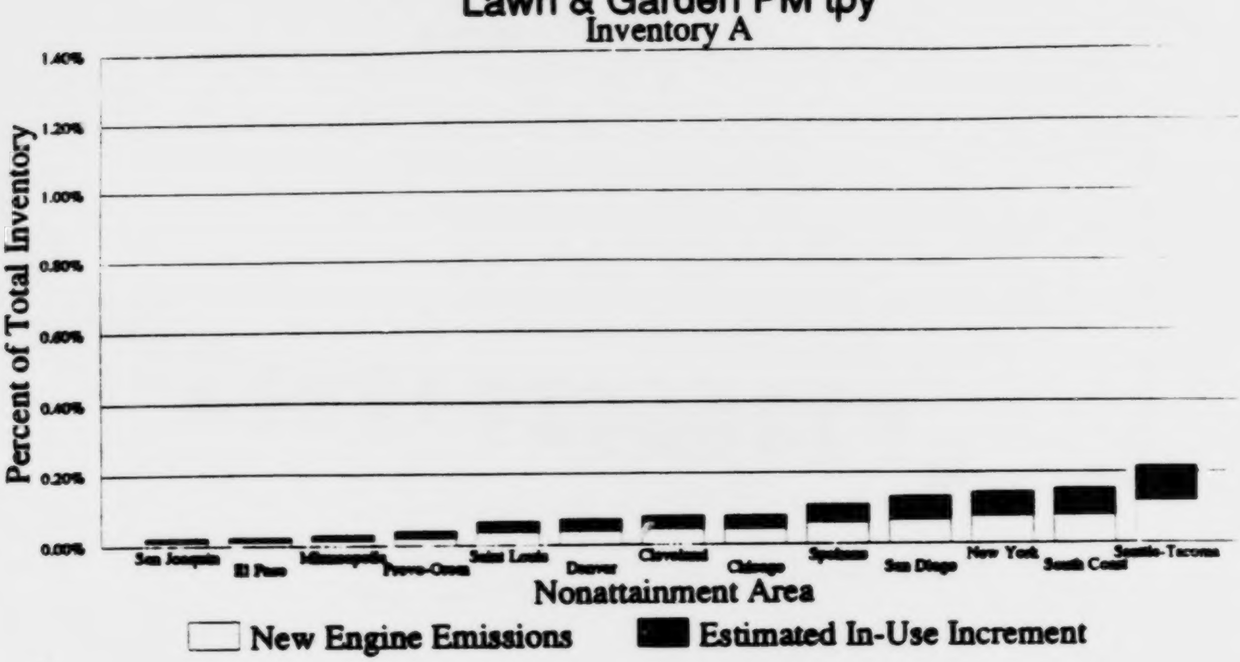

Lawn & Garden VOC tpsd
Inventory B
Percent of Total Inventory
12.00%
10.00%
8.00%
6.00%
4.00%
2.00%
0.00%
San Joaquin
Baton Rouge
Houston
South Coast
El Paso
New York
Philadelphia
Miami
Chicago
San Diego
Baltimore
Boston
Atlanta
Cleveland
Milwaukee
Saint Louis
Springfield
Hartford
Washington DC
Nonattainment Area
New Engine Emissions
Estimated In-Use Increment

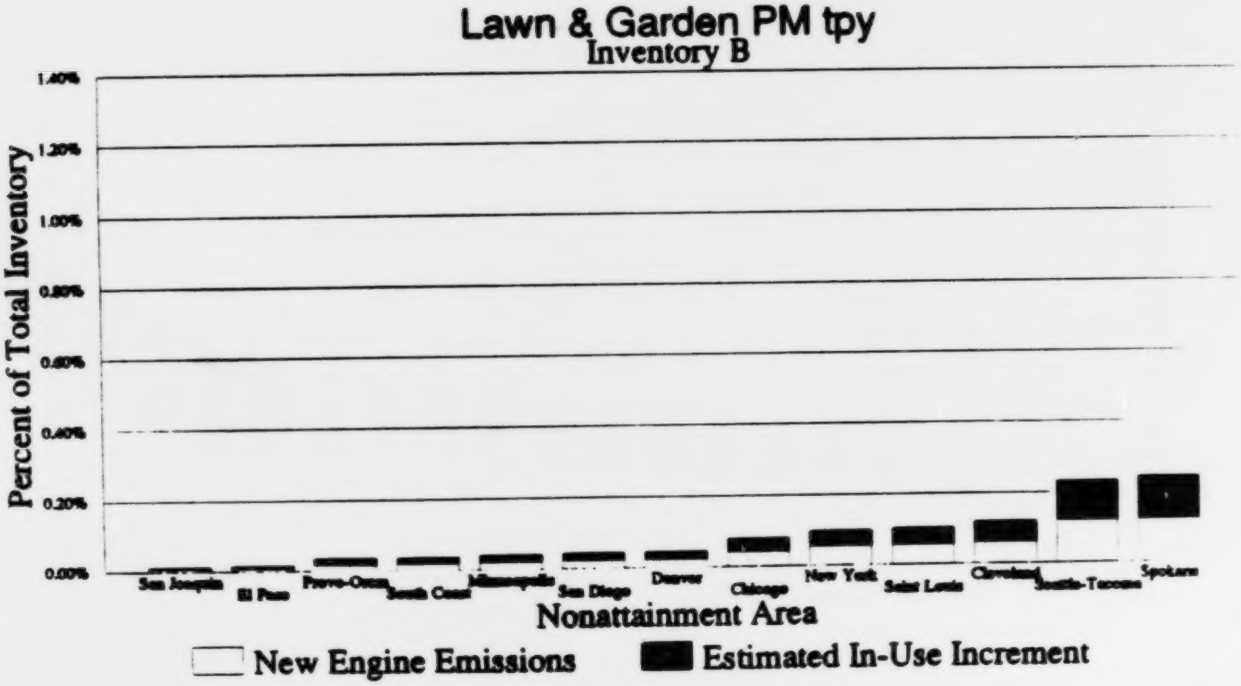

Lawn & Garden NOx tpsd
Inventory A
Percent of Total Inventory
1.40%
1.20%
1.00%
0.80%
0.60%
0.40%
0.20%
0.00%
Baton Rouge
Saint Louis
San Joaquin
Houston
Chicago
Milwaukee
Cleveland
Baltimore
Atlanta
El Paso
New York
Washington DC
Springfield
Philadelphia
Boston
Hartford
Miami
San Diego
South Coast
Nonattainment Area
New Engine Emissions
Estimated In-Use Increment

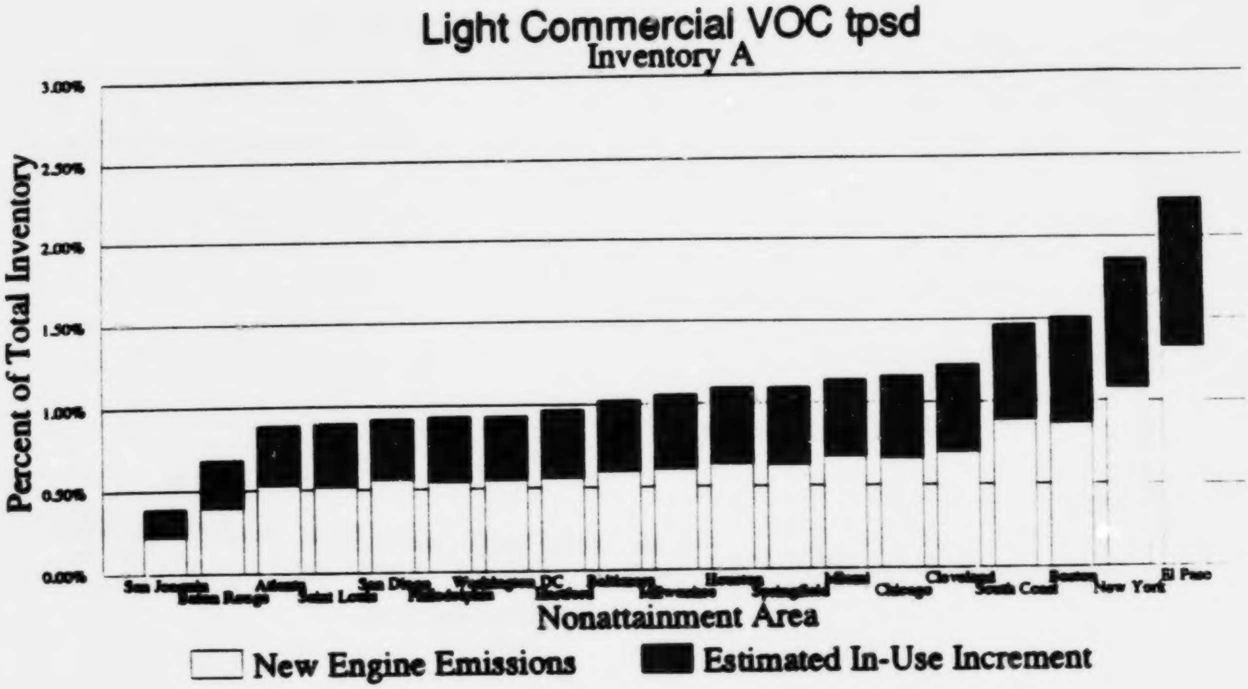

Lawn & Garden NOx tpsd
Inventory B
Percent of Total Inventory
1.40%
1.20%
1.00%
0.80%
0.60%
0.40%
0.20%
0.00%
Baton Rouge
Houston
San Joaquin
Saint Louis
Chicago
Baltimore
New York
Atlanta
Philadelphia
Boston
Cleveland
Milwaukee
El Paso
South Coast
Hartford
Miami
Springfield
San Diego
Washington DC
Nonattainment Area
New Engine Emissions
Estimated In-Use Increment


Lawn & Garden CO tpwd
Inventory A
Percent of Total Inventory
6.00%
5.00%
4.00%
3.00%
2.00%
1.00%
0.00%
Spokane
Minneapolis
Provo-Orem
Cleveland
Denver
Saint Louis
Hartford
Boston
New York
El Paso
Seattle-Tacoma
Washington DC
Baltimore
San Joaquin
South Coast
San Diego
Nonattainment Area
New Engine Emissions
Estimated In-Use Increment


Lawn & Garden CO tpwd
Inventory B
Percent of Total Inventory
6.00%
5.00%
4.00%
3.00%
2.00%
1.00%
0.00%
Spokane
Minneapolis
Provo-Orem
Cleveland
Denver
Saint Louis
Hartford
Boston
El Paso
New York
South Coast
Seattle-Tacoma
Baltimore
San Joaquin
San Diego
Washington DC
Nonattainment Area
New Engine Emissions
Estimated In-Use Increment


Lawn & Garden PM tpy
Inventory A
Percent of Total Inventory
1.40%
1.20%
1.00%
0.80%
0.60%
0.40%
0.20%
0.00%
San Joaquin
El Paso
Minneapolis
Provo-Orem
Saint Louis
Denver
Cleveland
Chicago
Spokane
San Diego
New York
South Coast
Seattle-Tacoma
Nonattainment Area
New Engine Emissions
Estimated In-Use Increment


Lawn & Garden PM tpy
Inventory B
Percent of Total Inventory
1.40%
1.20%
1.00%
0.80%
0.60%
0.40%
0.20%
0.00%
San Joaquin
El Paso
Provo-Orem
South Coast
Minneapolis
San Diego
Denver
Chicago
New York
Saint Louis
Cleveland
Seattle-Tacoma
Spokane
Nonattainment Area
New Engine Emissions
Estimated In-Use Increment


Light Commercial VOC tpsd
Inventory A
Percent of Total Inventory
3.00%
2.50%
2.00%
1.50%
1.00%
0.50%
0.00%
San Joaquin
Baton Rouge
Atlanta
Saint Louis
San Diego
Philadelphia
Washington DC
Hartford
Baltimore
Milwaukee
Houston
Springfield
Miami
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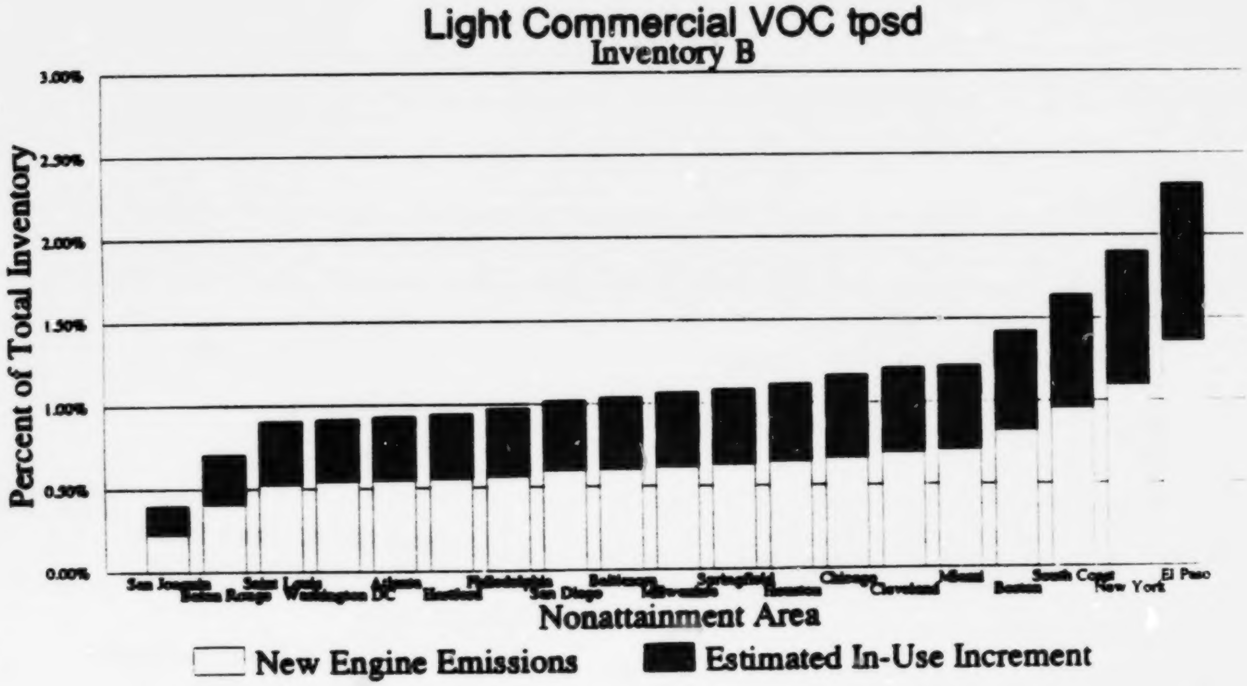
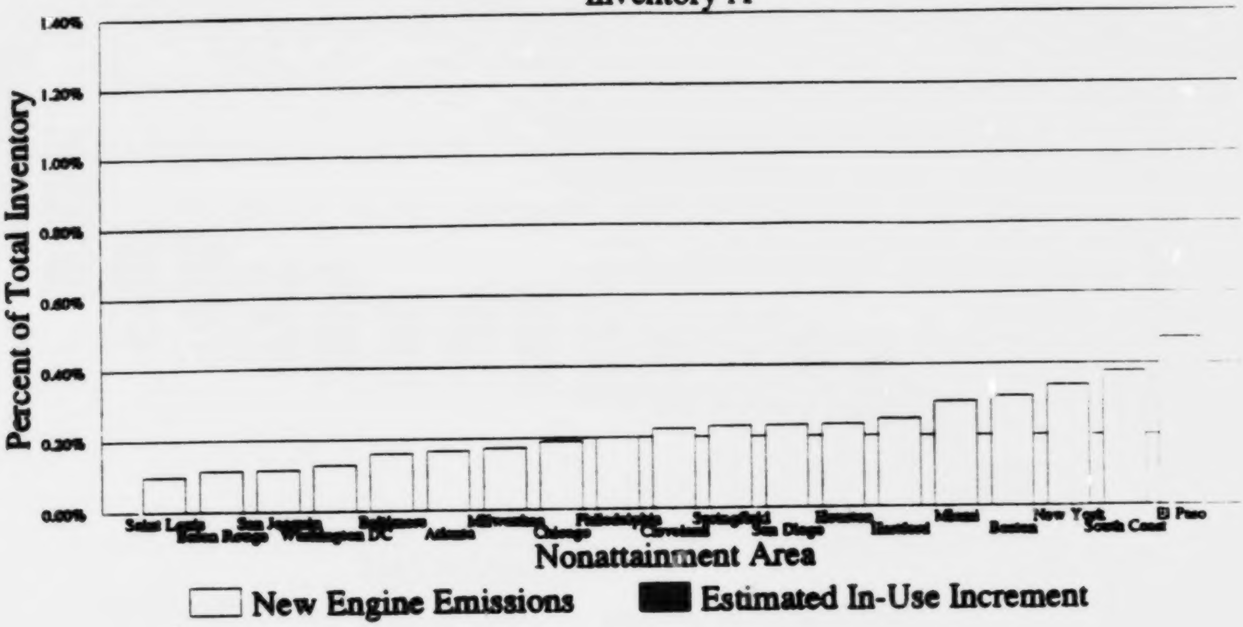
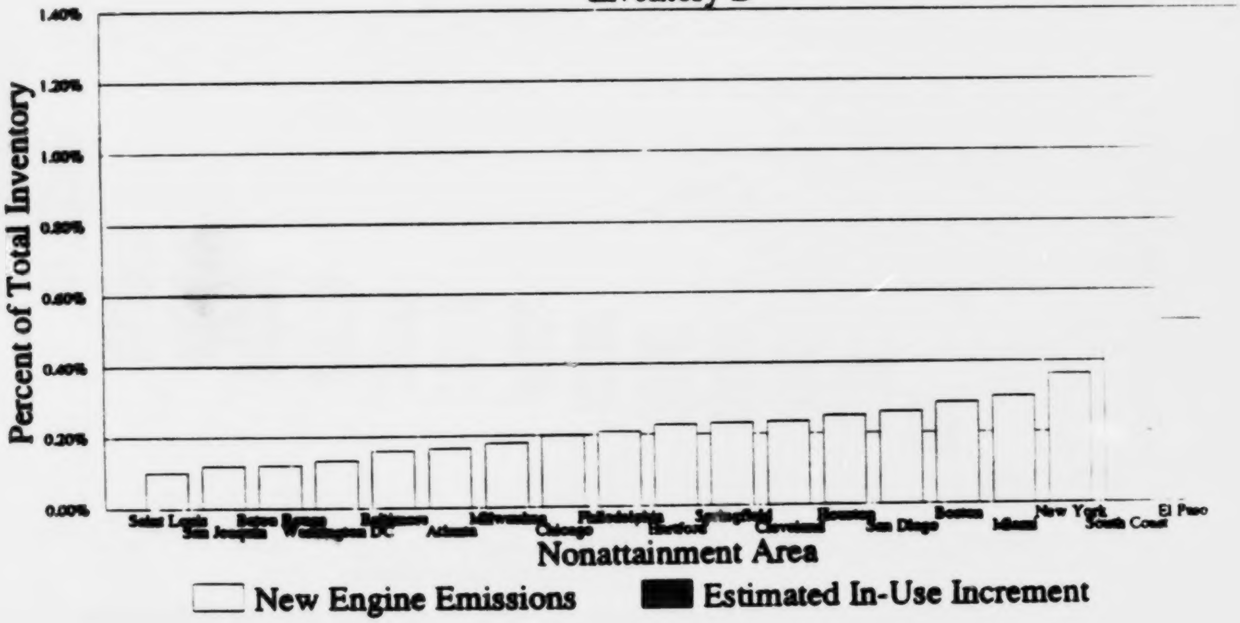
New York
El Paso
Nonattainment Area
New Engine Emissions
Estimated In-Use Increment

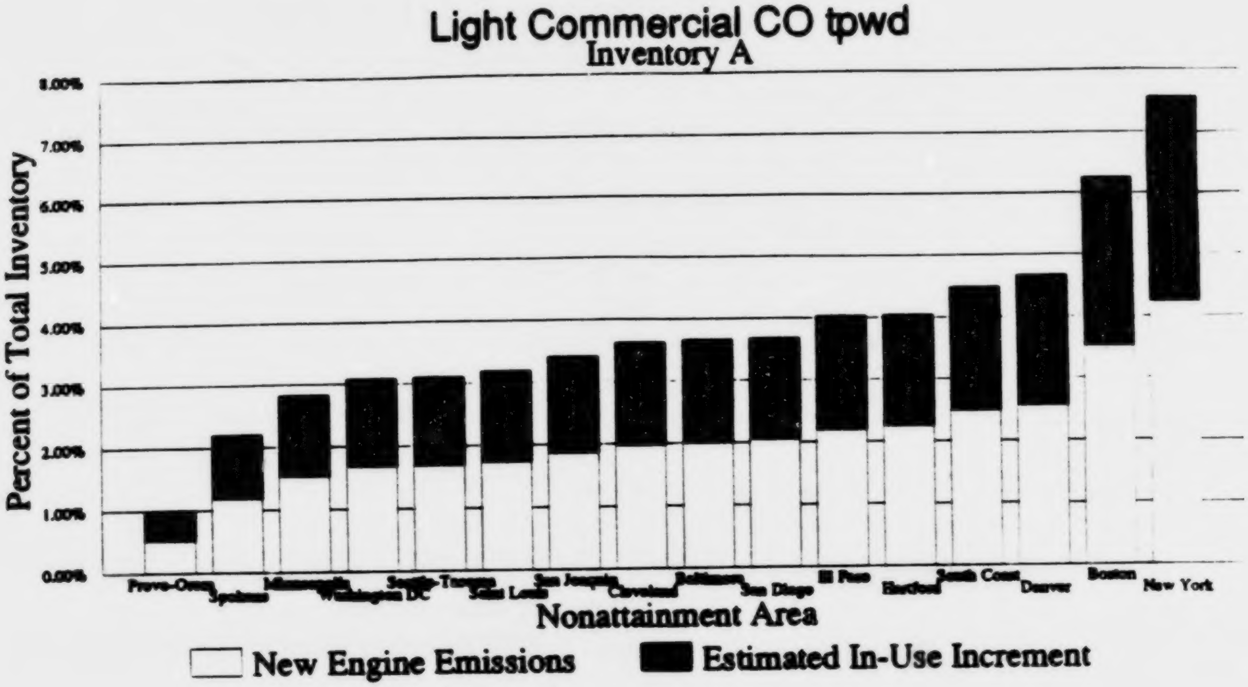

Light Commercial VOC tpsd
Inventory B
Percent of Total Inventory
3.00%
2.50%
2.00%
1.50%
1.00%
0.50%
0.00%
San Joaquin
Baton Rouge
Saint Louis
Washington DC
Atlanta
Hartford
Philadelphia
San Diego
Baltimore
Milwaukee
Springfield
Houston
Chicago
Cleveland
Miami
Boston
South Coast
New York
El Paso
Nonattainment Area
New Engine Emissions
Estimated In-Use Increment

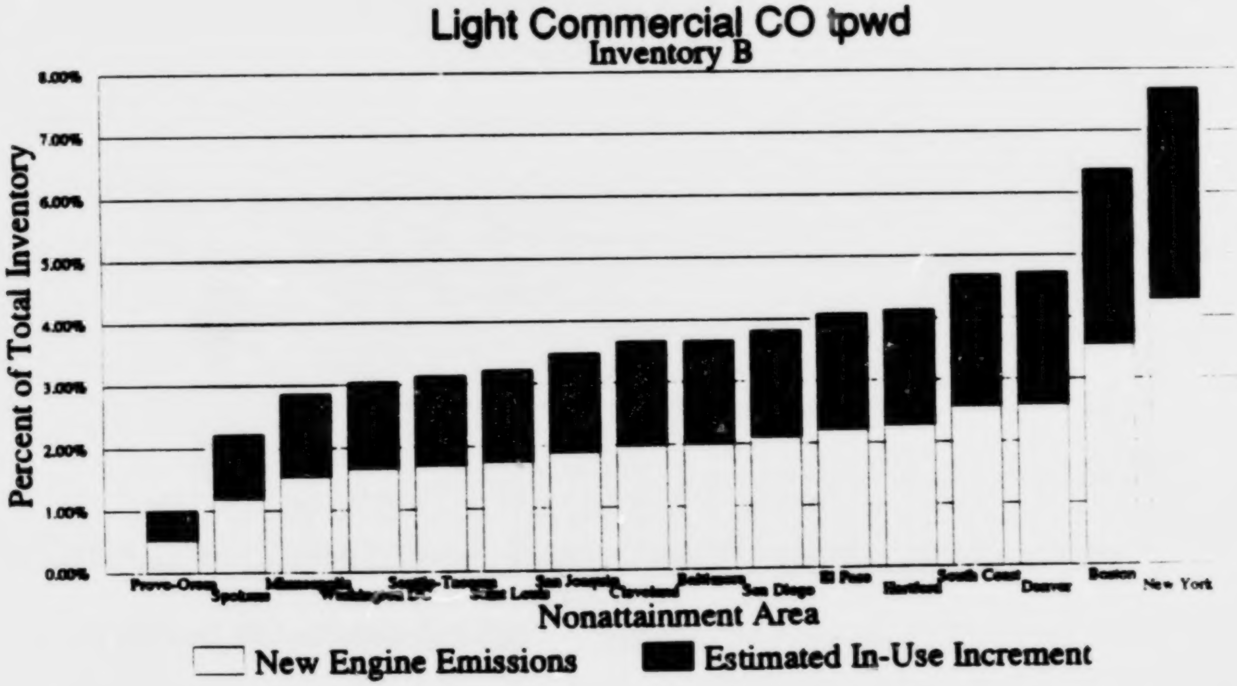
Light Commercial NOx tpsd
Inventory A



Light Commercial NOx tpsd
Inventory B




Light Commercial CO tpwd
Inventory A
Percent of Total Inventory
8.00%
7.00%
6.00%
5.00%
4.00%
3.00%
2.00%
1.00%
0.00%
Provo-Orem
Spokane
Minneapolis
Washington DC
Seattle-Tacoma
Saint Louis
San Joaquin
Cleveland
Baltimore
San Diego
El Paso
Hartford
South Coast
Denver
Boston
New York
Nonattainment Area
New Engine Emissions
Estimated In-Use Increment


Light Commercial CO tpwd
Inventory B
Percent of Total Inventory
8.00%
7.00%
6.00%
5.00%
4.00%
3.00%
2.00%
1.00%
0.00%
Provo-Orem
Spokane
Minneapolis
Washington DC
Seattle-Tacoma
Saint Louis
San Joaquin
Cleveland
Baltimore
San Diego
El Paso
Hartford
South Coast
Denver
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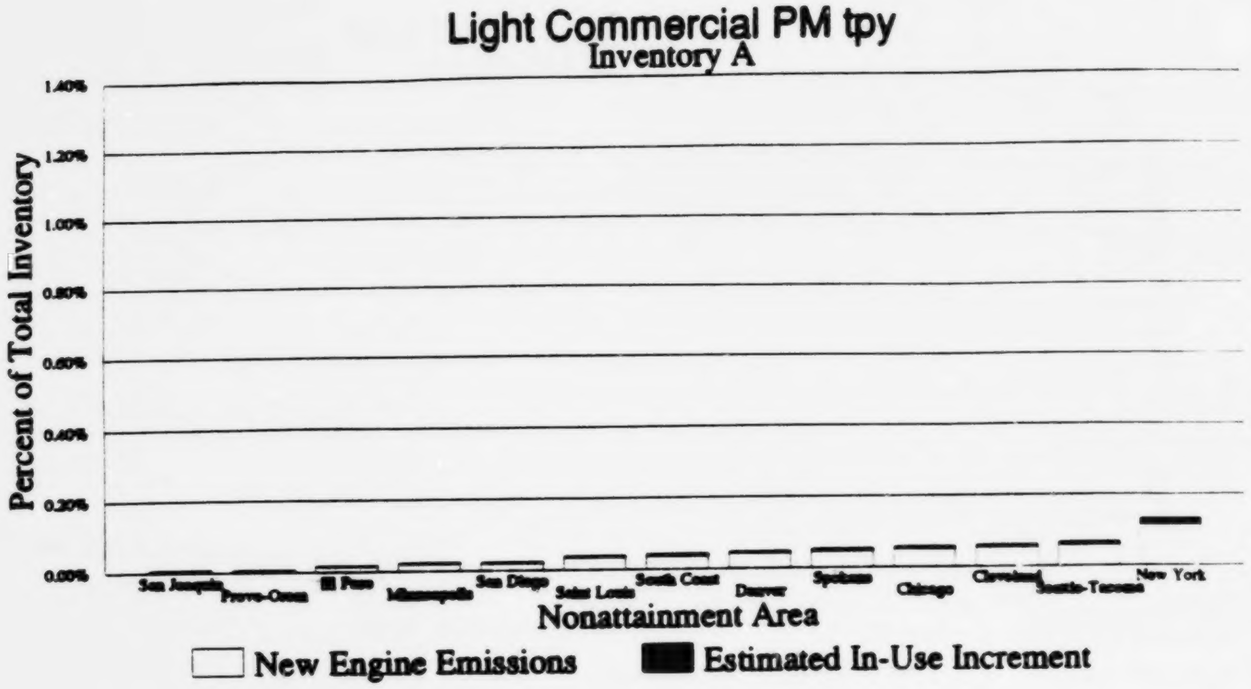
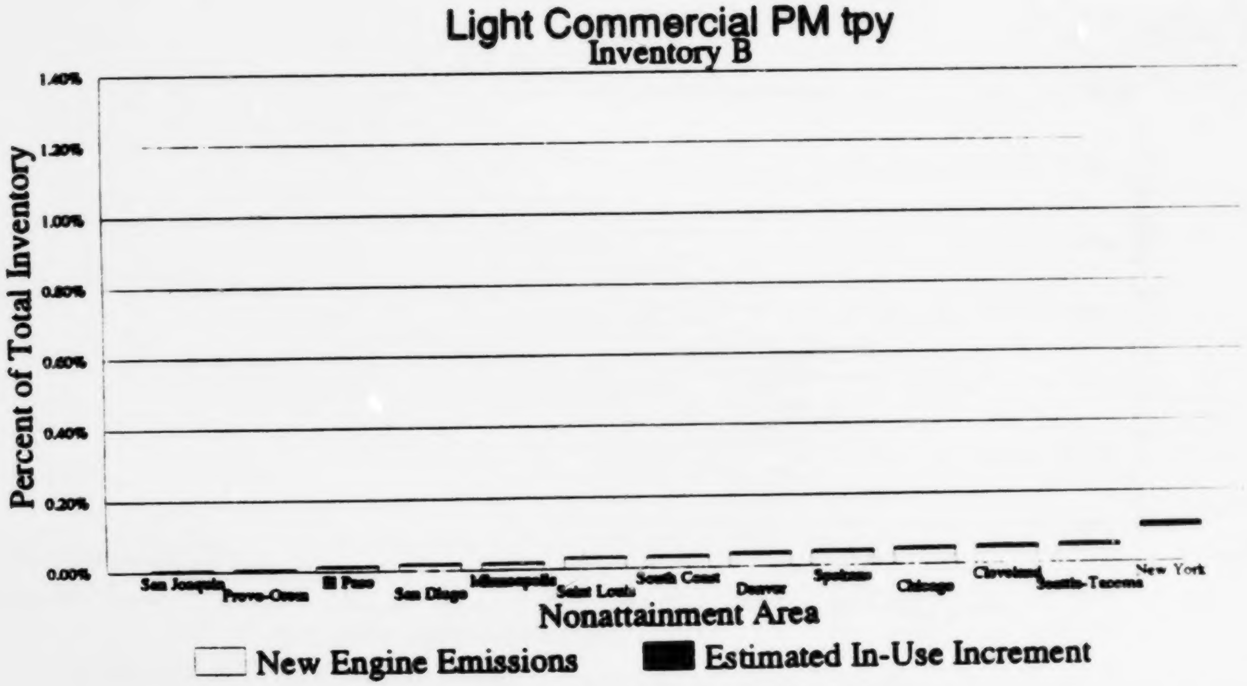
Nonattainment Area
New Engine Emissions
Estimated In-Use Increment


Light Commercial PM tpy
Inventory A
Percent of Total Inventory
1.40%
1.20%
1.00%
0.80%
0.60%
0.40%
0.20%
0.00%
San Joaquin
Provo-Orem
El Paso
Minneapolis
San Diego
Saint Louis
South Coast
Denver
Spokane
Chicago
Cleveland
Seattle-Tacoma
New York
Nonattainment Area
New Engine Emissions
Estimated In-Use Increment


Light Commercial PM tpy
Inventory B
Percent of Total Inventory
1.40%
1.20%
1.00%
0.80%
0.60%
0.40%
0.20%
0.00%
San Joaquin
Provo-Orem
El Paso
San Diego
Minneapolis
Saint Louis
South Coast
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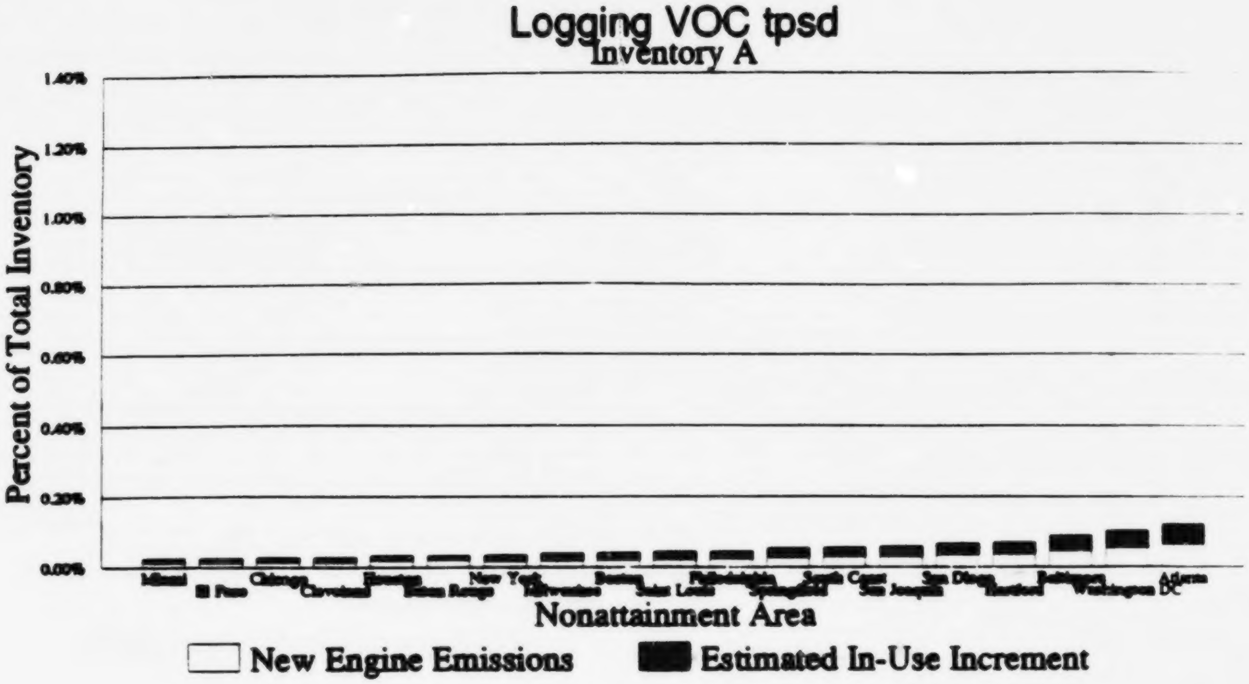
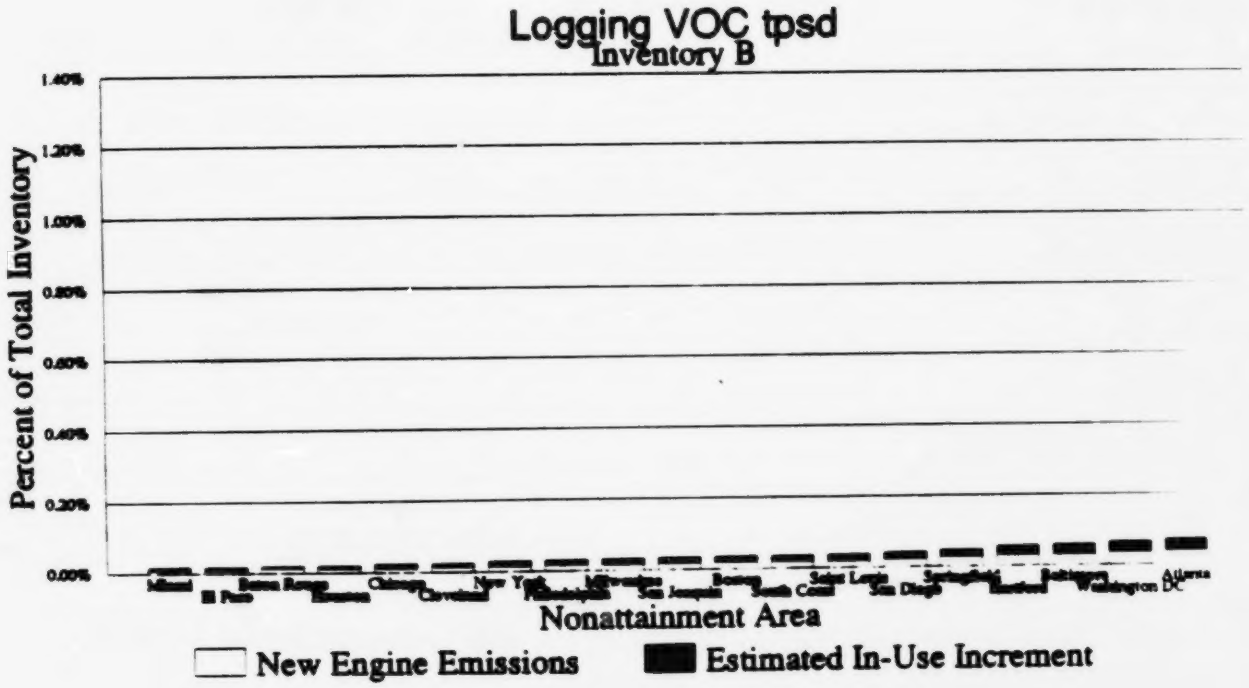
Cleveland
Seattle-Tacoma
New York
Nonattainment Area
New Engine Emissions
Estimated In-Use Increment


Logging VOC tpsd
Inventory A
Percent of Total Inventory
1.40%
1.20%
1.00%
0.80%
0.60%
0.40%
0.20%
0.00%
Miami
El Paso
Chicago
Cleveland
Houston
Baton Rouge
New York
Milwaukee
Boston
Saint Louis
Philadelphia
Springfield
South Coast
San Joaquin
San Diego
Hartford
Baltimore
Washington DC
Atlanta
Nonattainment Area
New Engine Emissions
Estimated In-Use Increment


Logging VOC tpsd
Inventory B
Percent of Total Inventory
1.40%
1.20%
1.00%
0.80%
0.60%
0.40%
0.20%
0.00%
Miami
El Paso
Baton Rouge
Houston
Chicago
Cleveland
New York
Philadelphia
Milwaukee
San Joaquin
Boston
South Coast
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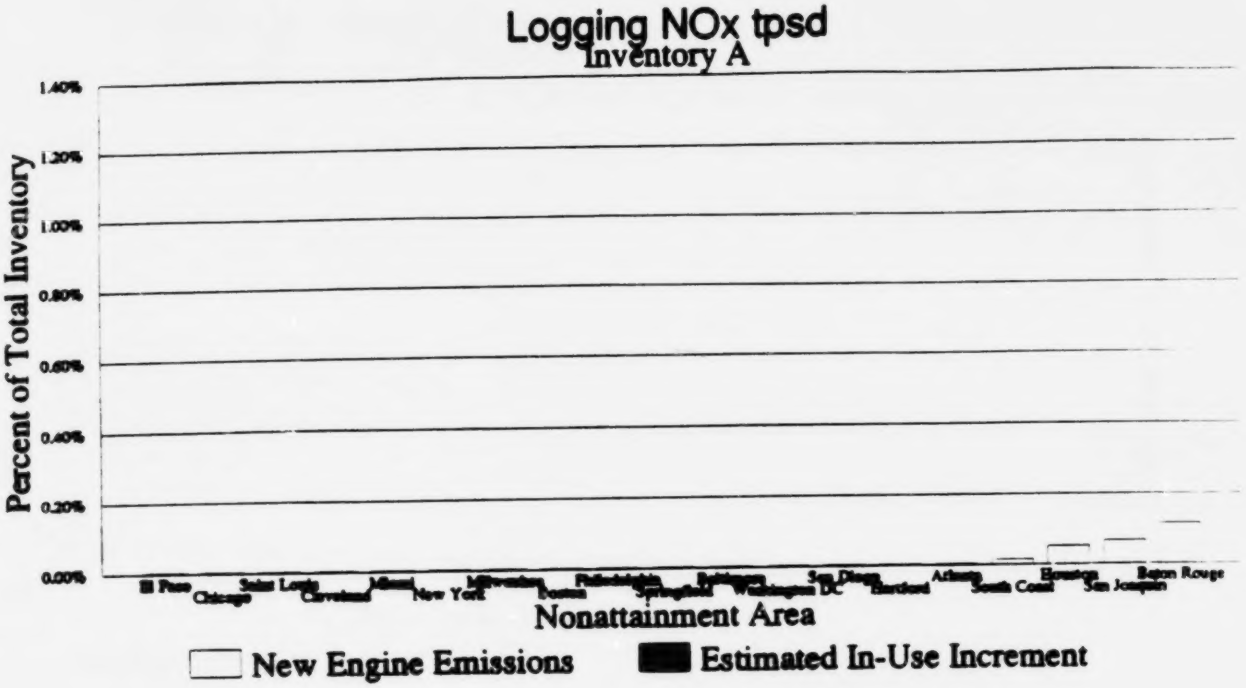
Springfield
Hartford
Baltimore
Washington DC
Atlanta
Nonattainment Area
New Engine Emissions
Estimated In-Use Increment


Logging NOx tpsd
Inventory A
Percent of Total Inventory
1.40%
1.20%
1.00%
0.80%
0.60%
0.40%
0.20%
0.00%
El Paso
Chicago
Saint Louis
Cleveland
Miami
New York
Milwaukee
Boston
Philadelphia
Springfield
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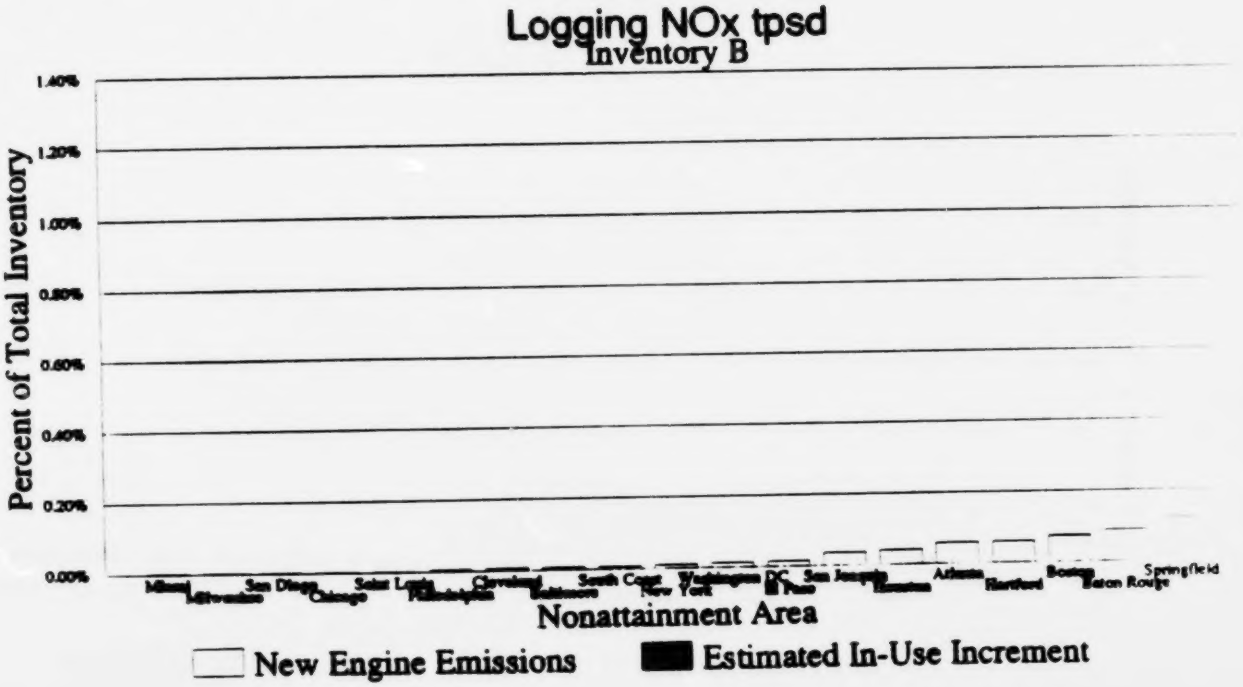
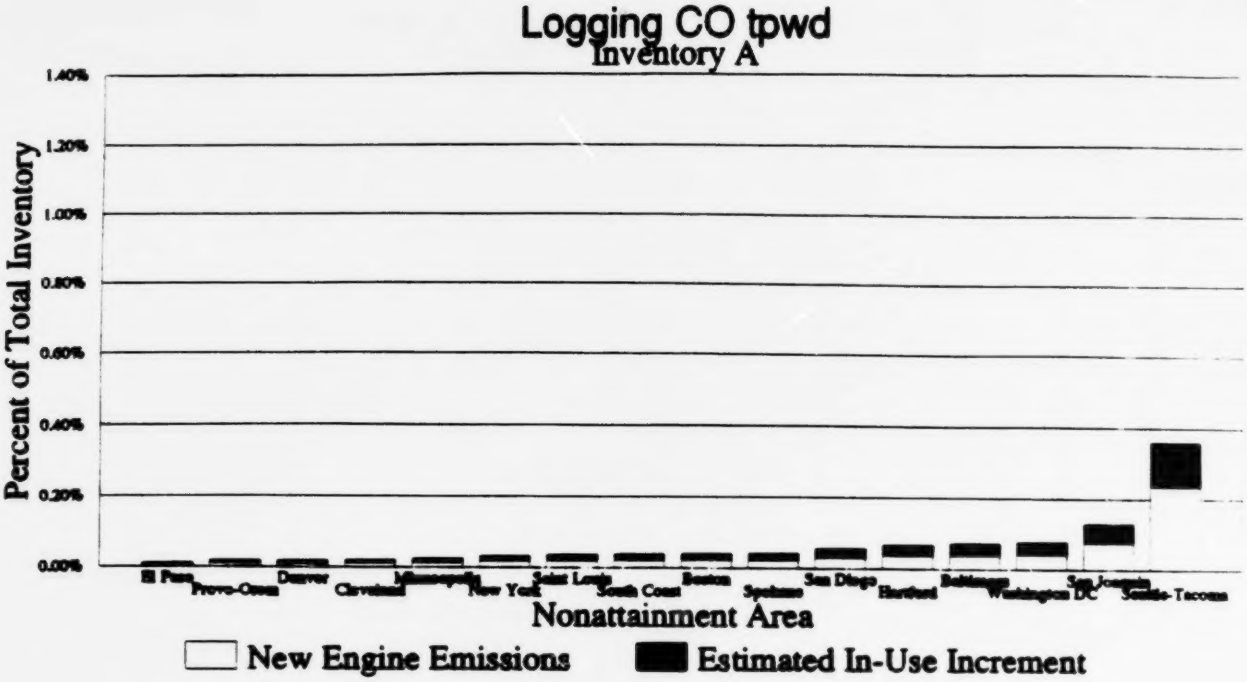
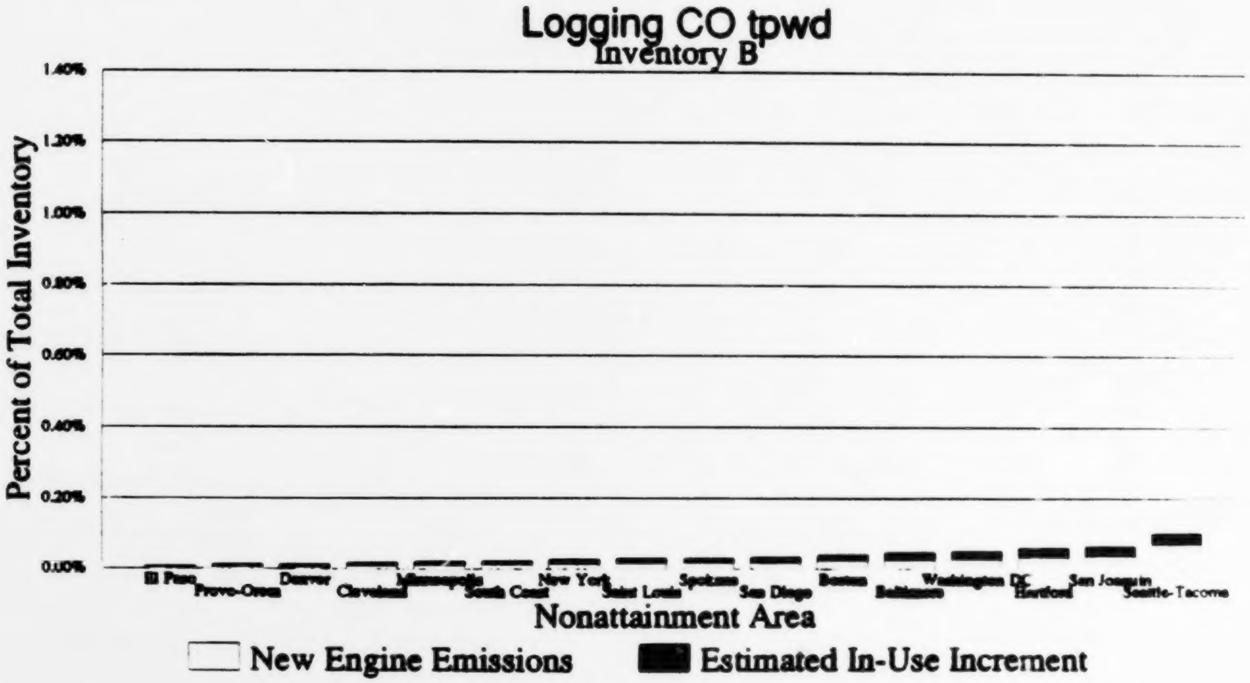
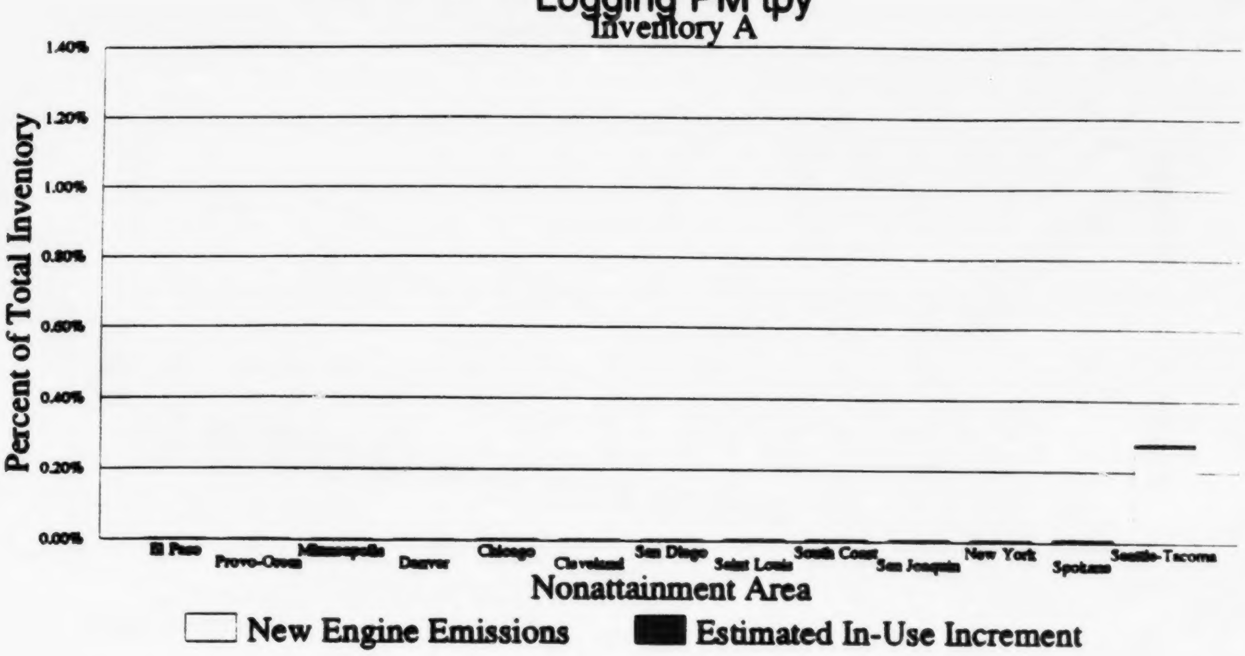
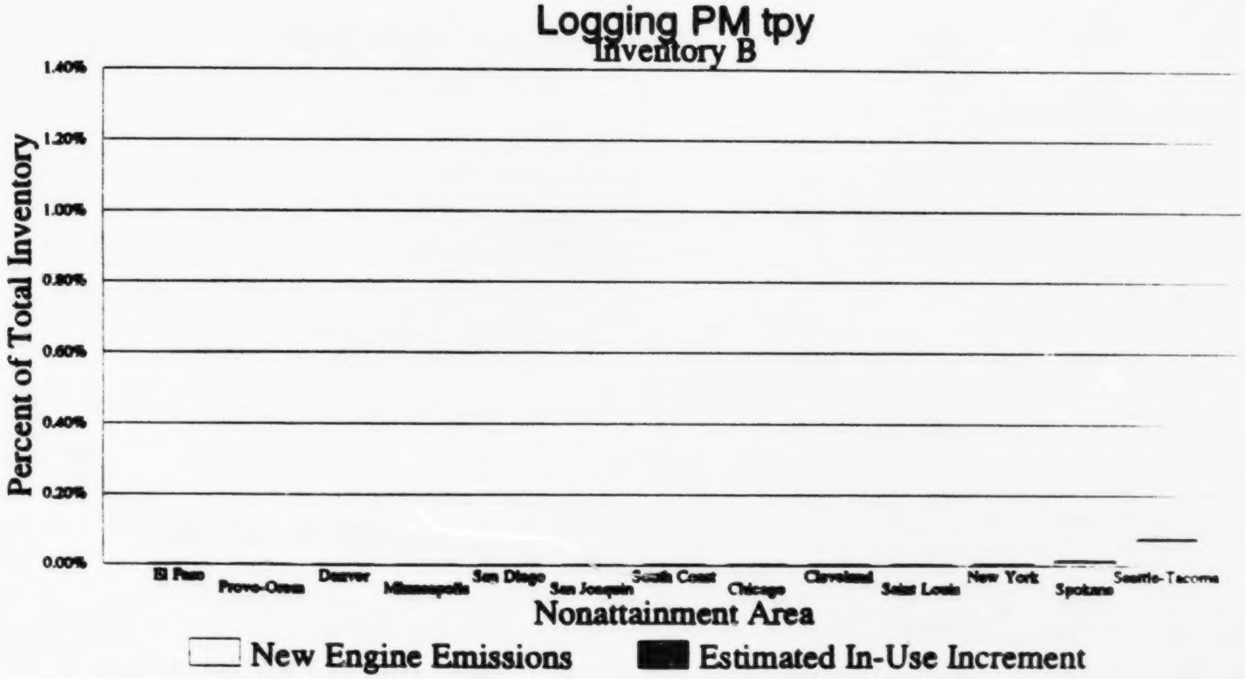
Washington DC
San Diego
Hartford
Atlanta
South Coast
Houston
San Joaquin
Baton Rouge
Nonattainment Area
New Engine Emissions
Estimated In-Use Increment

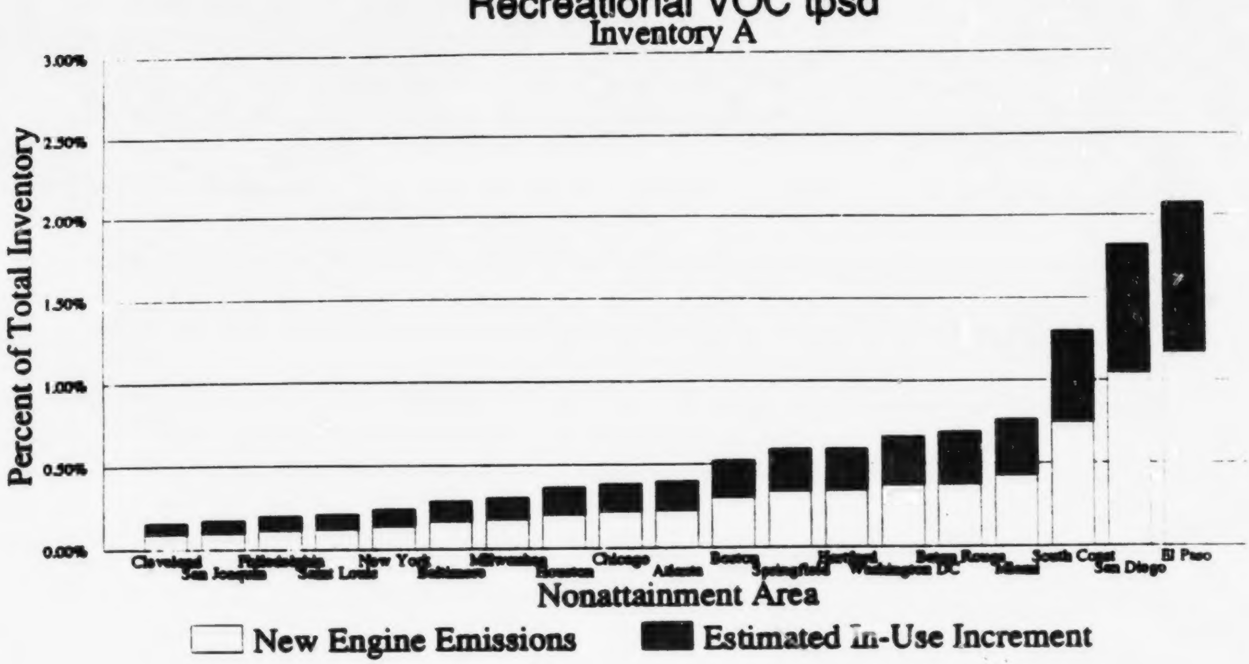

Logging NOx tpsd
Inventory B
Percent of Total Inventory
1.40%
1.20%
1.00%
0.80%
0.60%
0.40%
0.20%
0.00%
Miami
Milwaukee
San Diego
Chicago
Saint Louis
Philadelphia
Cleveland
Baltimore
South Coast
New York
Washington DC
El Paso
San Joaquin
Houston
Atlanta
Hartford
Boston
Baton Rouge
Springfield
Nonattainment Area
New Engine Emissions
Estimated In-Use Increment

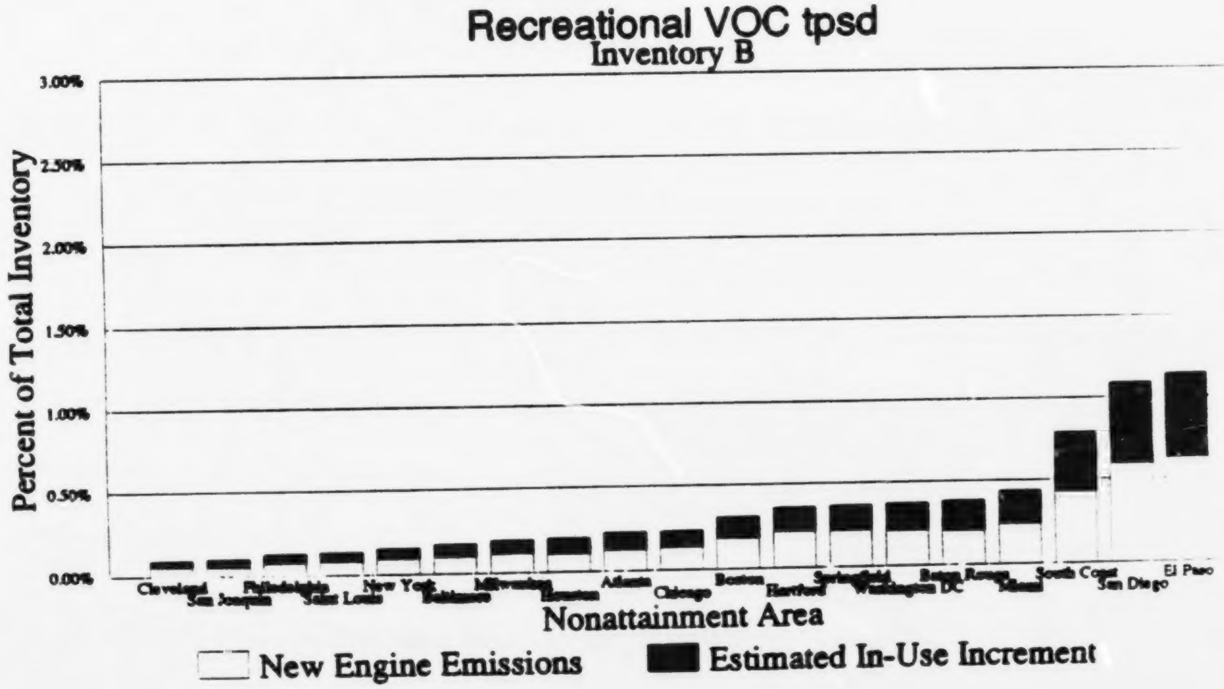

Logging CO tpwd
Inventory A


Logging CO tpwd
Inventory B


Logging PM tpy
Inventory A
Percent of Total Inventory
1.40%
1.20%
1.00%
0.80%
0.60%
0.40%
0.20%
0.00%
El Paso
Provo-Orem
Minneapolis
Denver
Chicago
Cleveland
San Diego
Saint Louis
South Coast
San Joaquin
New York
Spokane
Seattle-Tacoma
Nonattainment Area
New Engine Emissions
Estimated In-Use Increment


Logging PM tpy
Inventory B
Percent of Total Inventory
1.40%
1.20%
1.00%
0.80%
0.60%
0.40%
0.20%
0.00%
El Paso
Provo-Orem
Denver
Minneapolis
San Diego
San Joaquin
South Coast
Chicago
Cleveland
Saint Louis
New York
Spokane
Seattle-Tacoma
Nonattainment Area
New Engine Emissions
Estimated In-Use Increment


Recreational VOC tpsd
Inventory A
Percent of Total Inventory
3.00%
2.50%
2.00%
1.50%
1.00%
0.50%
0.00%
Cleveland
San Joaquin
Philadelphia
Saint Louis
New York
Baltimore
Milwaukee
Houston
Chicago
Atlanta
Boston
Springfield
Hartford
Washington DC
Baton Rouge
Miami
South Coast
San Diego
El Paso
Nonattainment Area
New Engine Emissions
Estimated In-Use Increment


Recreational VOC tpsd
Inventory B
Percent of Total Inventory
3.00%
2.50%
2.00%
1.50%
1.00%
0.50%
0.00%
Cleveland
San Joaquin
Philadelphia
Saint Louis
New York
Baltimore
Milwaukee
Houston
Atlanta
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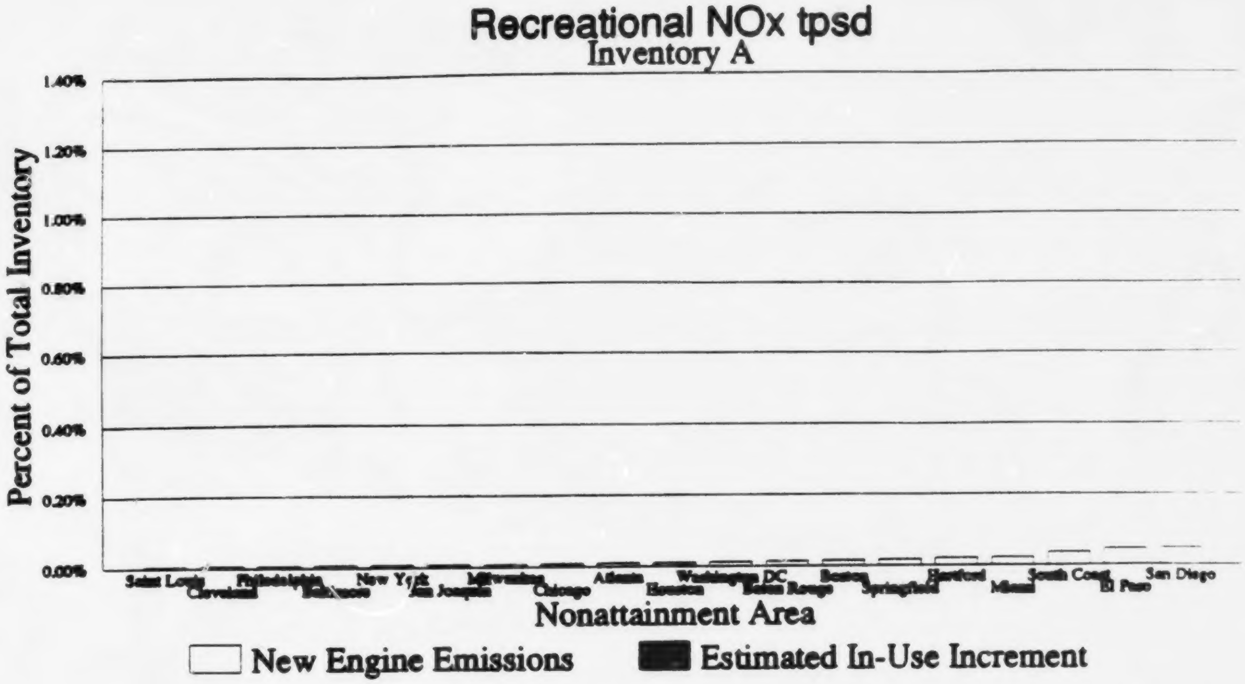
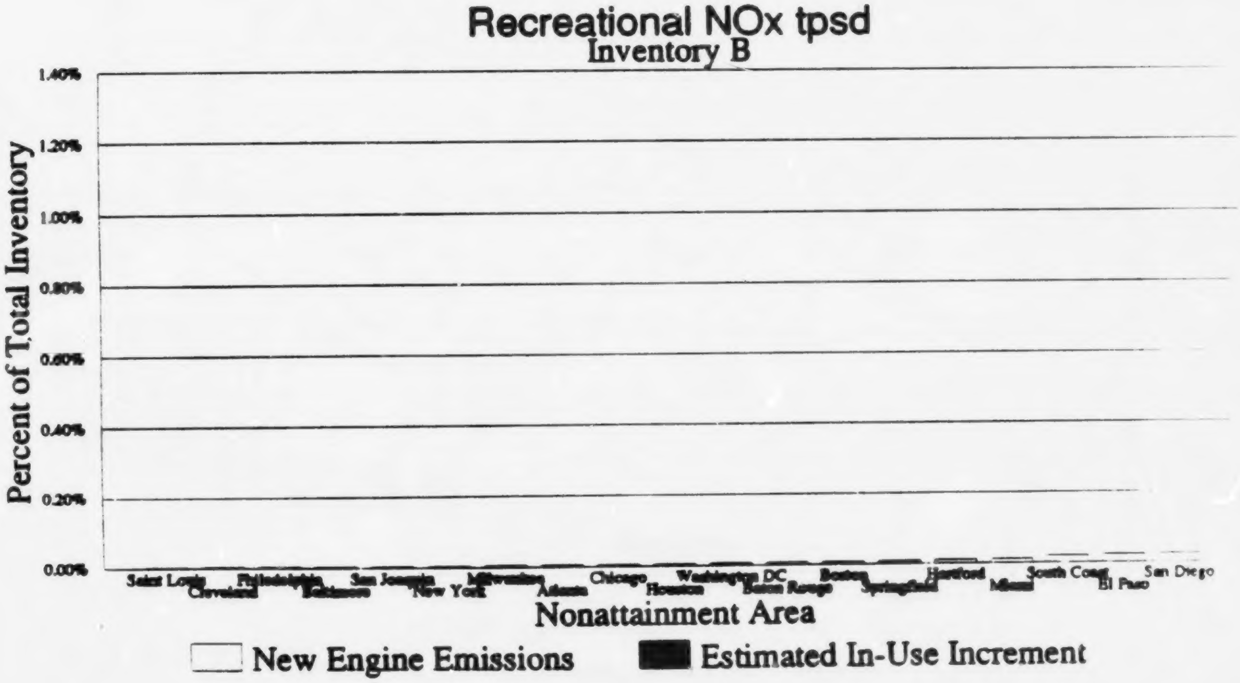
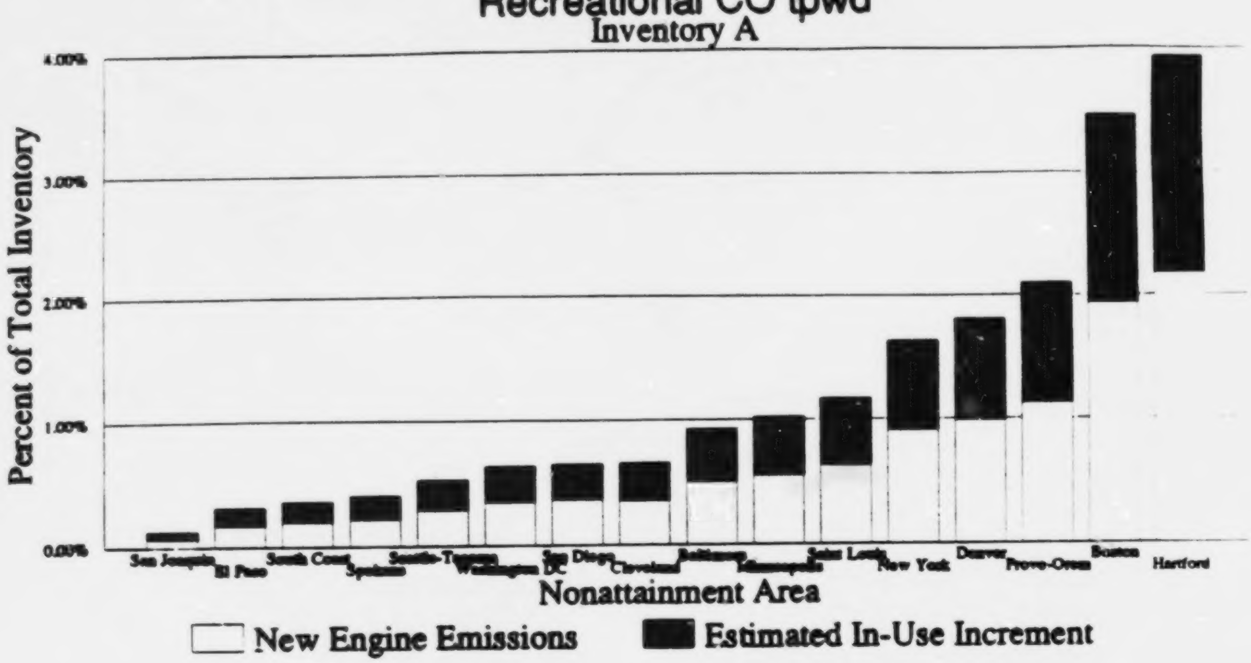
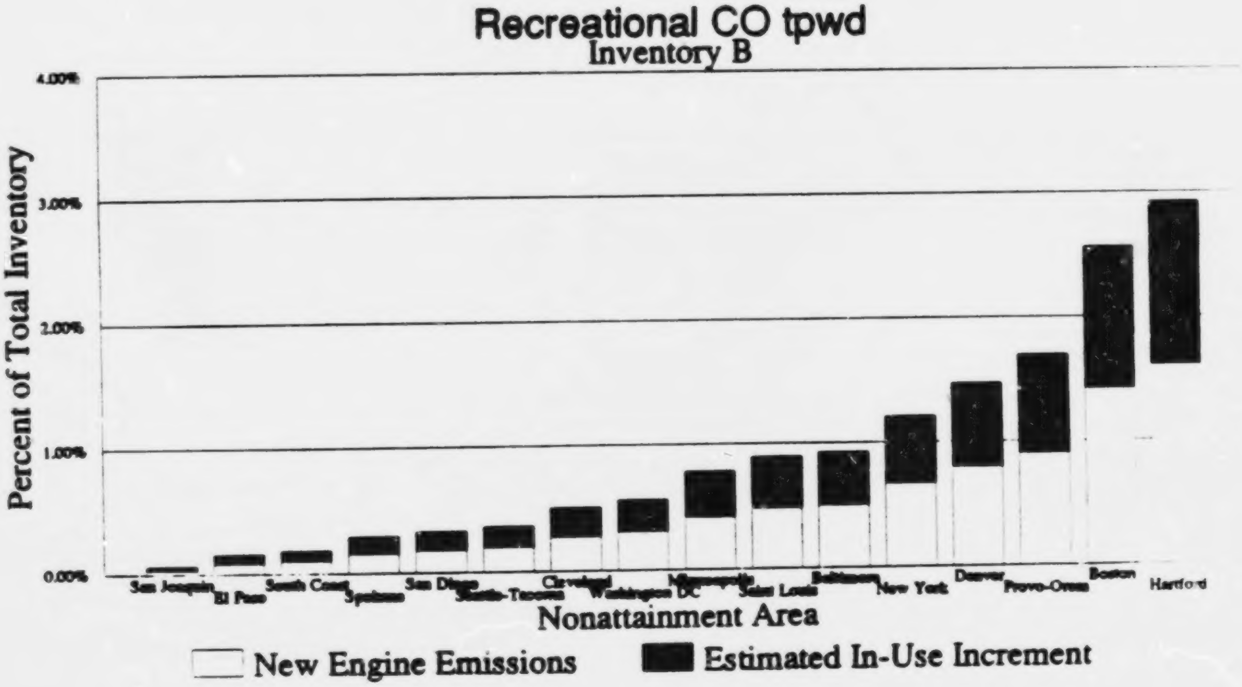
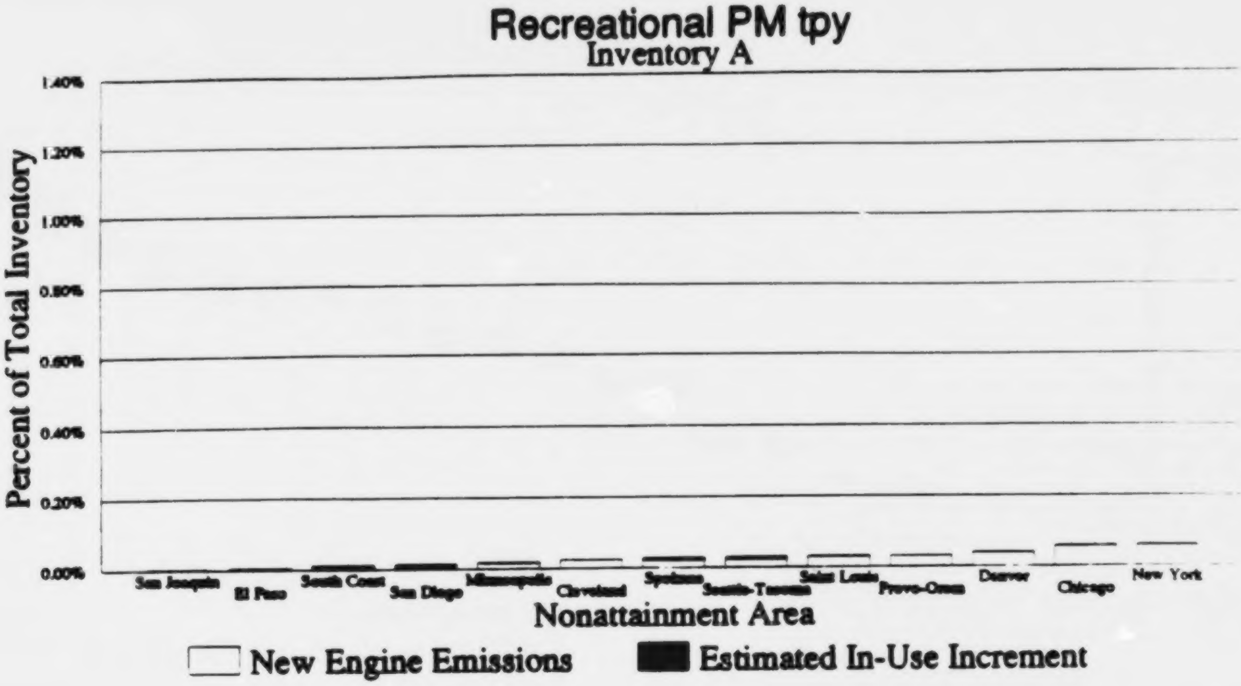
Boston
Hartford
Springfield
Washington DC
Baton Rouge
Miami
South Coast
San Diego
El Paso
Nonattainment Area
New Engine Emissions
Estimated In-Use Increment

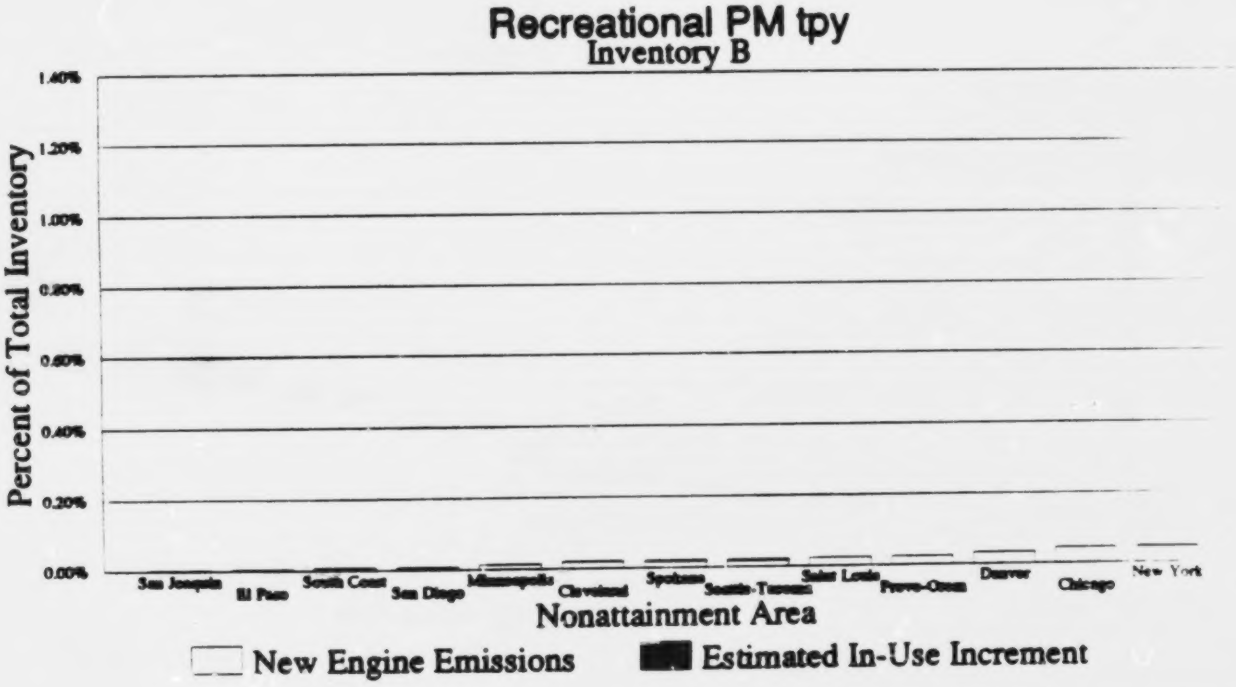

Recreational NOx tpsd
Inventory A
1.40%
1.20%
1.00%
0.80%
0.60%
0.40%
0.20%
0.00%
Percent of Total Inventory
Saint Louis
Cleveland
Philadelphia
Baltimore
New York
San Joaquin
Milwaukee
Chicago
Atlanta
Houston
Washington DC
Baton Rouge
Boston
Springfield
Hartford
Miami
South Coast
El Paso
San Diego
Nonattainment Area
New Engine Emissions
Estimated In-Use Increment


Recreational NOx tpsd
Inventory B
1.40%
1.20%
1.00%
0.80%
0.60%
0.40%
0.20%
0.00%
Percent of Total Inventory
Saint Louis
Cleveland
Philadelphia
Baltimore
San Joaquin
New York
Milwaukee
Atlanta
Chicago
Houston
Washington DC
Baton Rouge
Boston
Springfield
Hartford
Miami
South Coast
El Paso
San Diego
Nonattainment Area
New Engine Emissions
Estimated In-Use Increment


Recreational CO tpwd
Inventory A
4.00%
3.00%
2.00%
1.00%
0.00%
Percent of Total Inventory
San Joaquin
El Paso
South Coast
Spokane
Seattle-Tacoma
Washington DC
San Diego
Cleveland
Baltimore
Minneapolis
Saint Louis
New York
Denver
Provo-Orem
Boston
Hartford
Nonattainment Area
New Engine Emissions
Estimated In-Use Increment


Recreational CO tpwd
Inventory B
4.00%
3.00%
2.00%
1.00%
0.00%
Percent of Total Inventory
San Joaquin
El Paso
South Coast
Spokane
San Diego
Seattle-Tacoma
Cleveland
Washington DC
Minneapolis
Saint Louis
Baltimore
New York
Denver
Provo-Orem
Boston
Hartford
Nonattainment Area
New Engine Emissions
Estimated In-Use Increment


Recreational PM tpy
Inventory A
Percent of Total Inventory
1.40%
1.20%
1.00%
0.80%
0.60%
0.40%
0.20%
0.00%
San Joaquin
El Paso
South Coast
San Diego
Minneapolis
Cleveland
Spokane
Seattle-Tacoma
Saint Louis
Provo-Orem
Denver
Chicago
New York
Nonattainment Area
New Engine Emissions
Estimated In-Use Increment


Recreational PM tpy
Inventory B
Percent of Total Inventory
1.40%
1.20%
1.00%
0.80%
0.60%
0.40%
0.20%
0.00%
San Joaquin
El Paso
South Coast
San Diego
Minneapolis
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Spokane
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Saint Louis
Provo-Orem
Denver
Chicago
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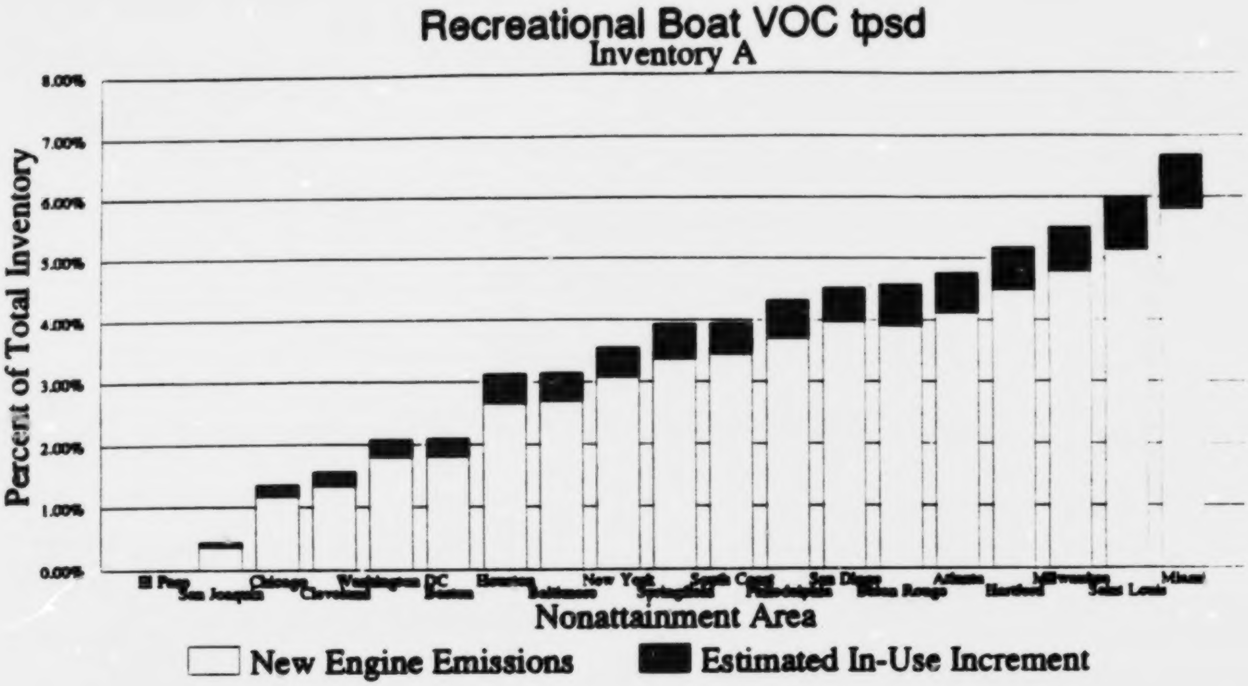
New Engine Emissions
Estimated In-Use Increment


Recreational Boat VOC tpsd
Inventory A
Percent of Total Inventory
8.00%
7.00%
6.00%
5.00%
4.00%
3.00%
2.00%
1.00%
0.00%
El Paso
San Joaquin
Chicago
Cleveland
Washington DC
Boston
Houston
Baltimore
New York
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South Coast
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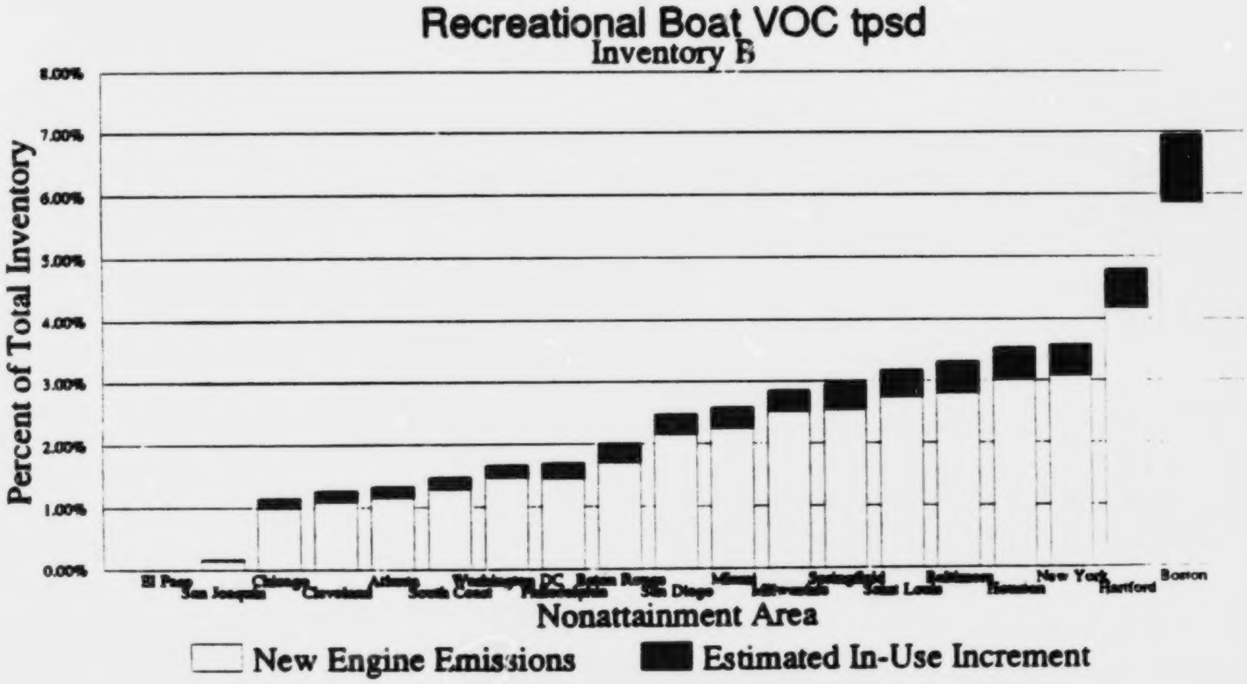
Saint Louis
Miami
Nonattainment Area
New Engine Emissions
Estimated In-Use Increment


Recreational Boat VOC tpsd
Inventory B
Percent of Total Inventory
8.00%
7.00%
6.00%
5.00%
4.00%
3.00%
2.00%
1.00%
0.00%
El Paso
San Joaquin
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Cleveland
Atlanta
South Coast
Washington DC
Philadelphia
Baton Rouge
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Miami
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Saint Louis
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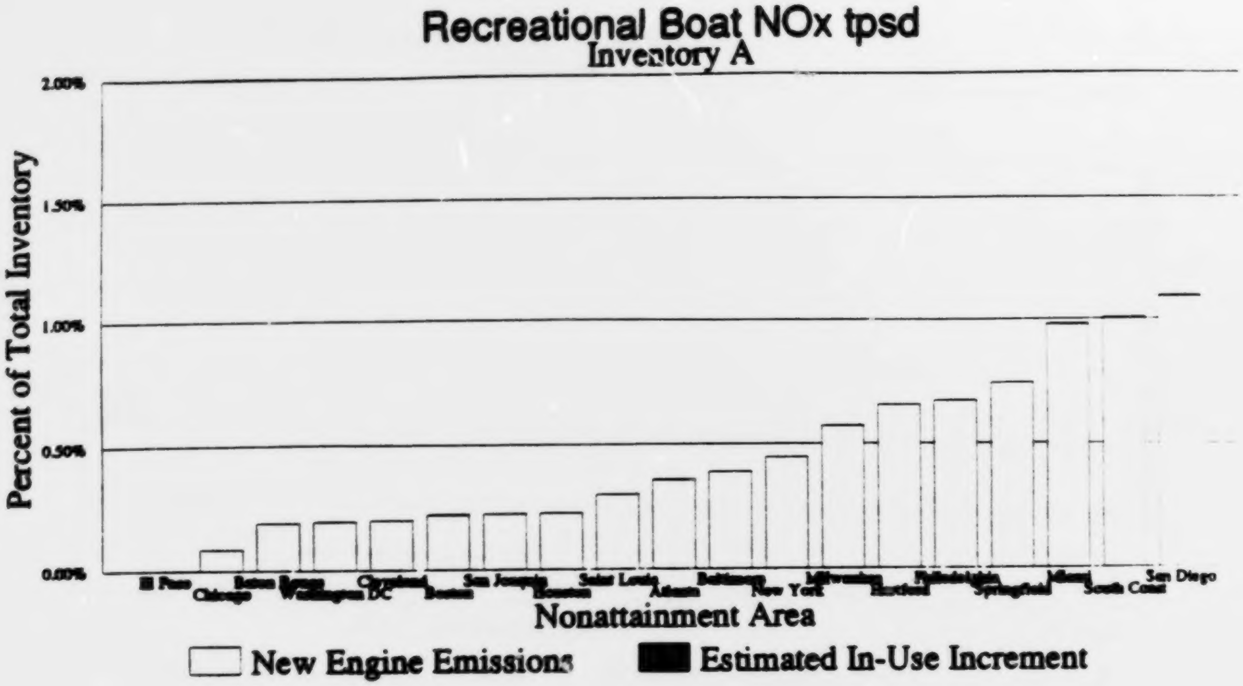
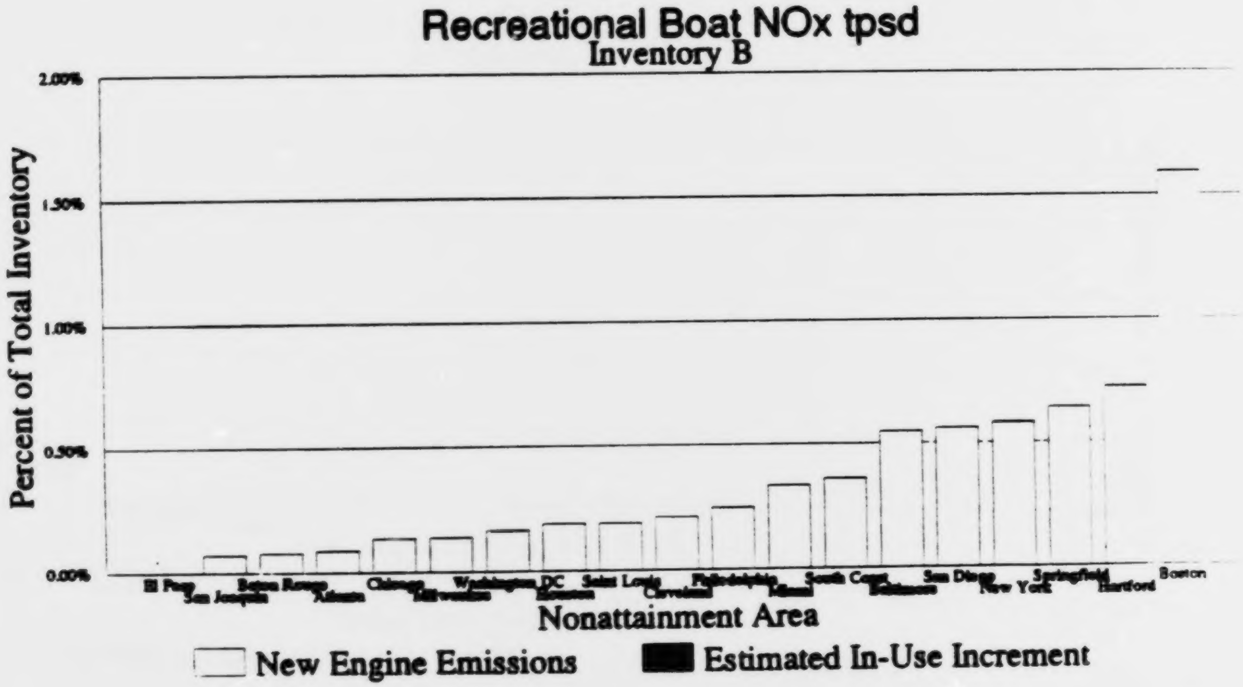
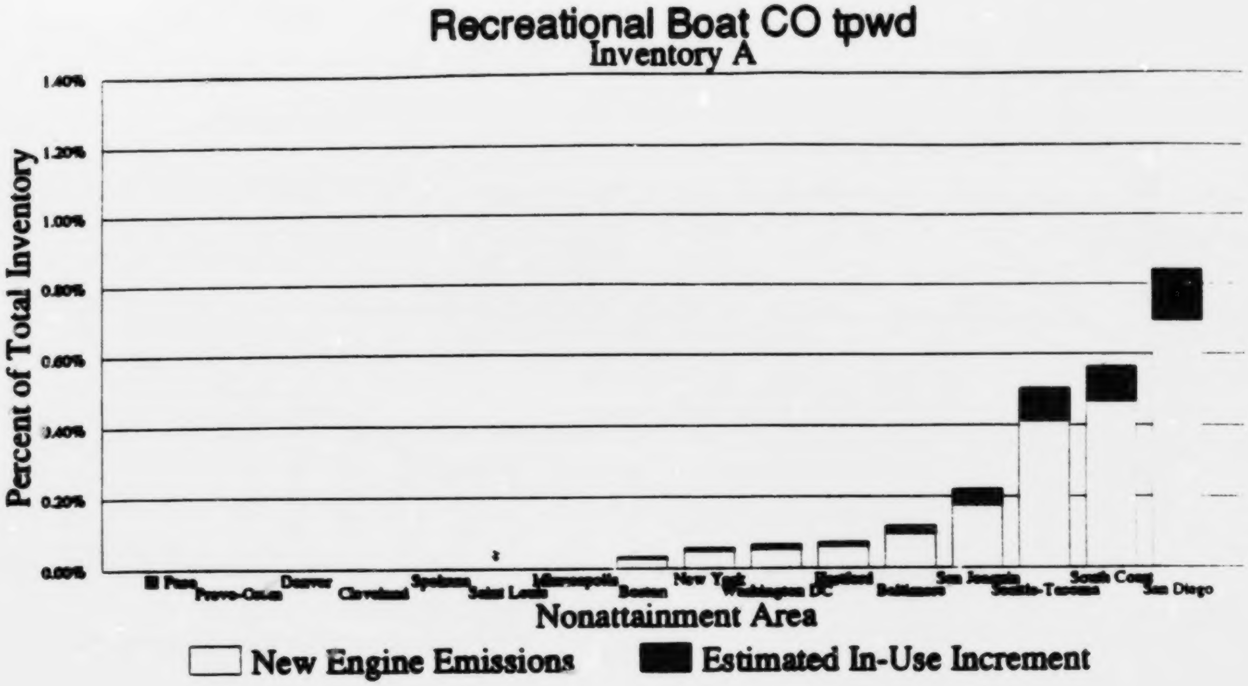
New York
Hartford
Boston
Nonattainment Area
New Engine Emissions
Estimated In-Use Increment


Recreational Boat NOx tpsd
Inventory A
2.00%
1.50%
1.00%
0.50%
0.00%
Percent of Total Inventory
El Paso
Chicago
Baton Rouge
Washington DC
Cleveland
Boston
San Joaquin
Houston
Saint Louis
Atlanta
Baltimore
New York
Milwaukee
Hartford
Philadelphia
Springfield
Miami
South Coast
San Diego
Nonattainment Area
New Engine Emissions
Estimated In-Use Increment


Recreational Boat NOx tpsd
Inventory B
2.00%
1.50%
1.00%
0.50%
0.00%
Percent of Total Inventory
El Paso
San Joaquin
Baton Rouge
Atlanta
Chicago
Milwaukee
Washington DC
Houston
Saint Louis
Cleveland
Philadelphia
Miami
South Coast
Baltimore
San Diego
New York
Springfield
Hartford
Boston
Nonattainment Area
New Engine Emissions
Estimated In-Use Increment


Recreational Boat CO tpwd
Inventory A
Percent of Total Inventory
1.40%
1.20%
1.00%
0.80%
0.60%
0.40%
0.20%
0.00%
El Paso
Provo-Orem
Denver
Cleveland
Spokane
Saint Louis
Minneapolis
Boston
New York
Washington DC
Hartford
Baltimore
San Joaquin
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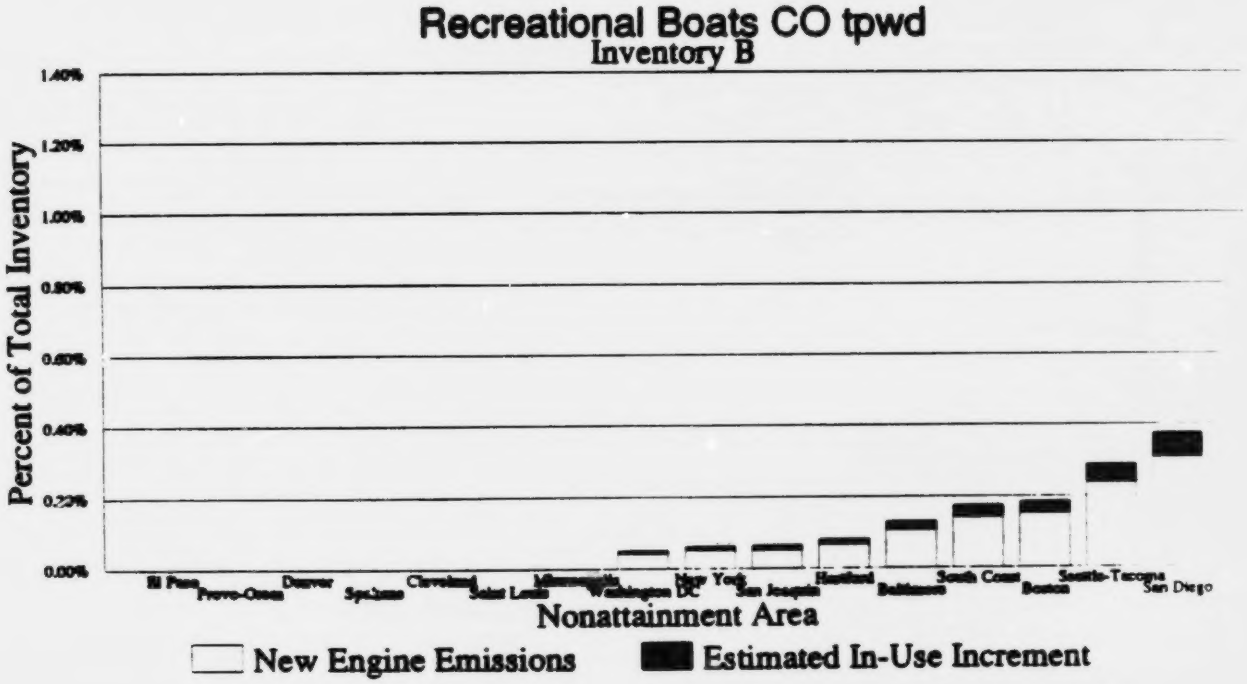
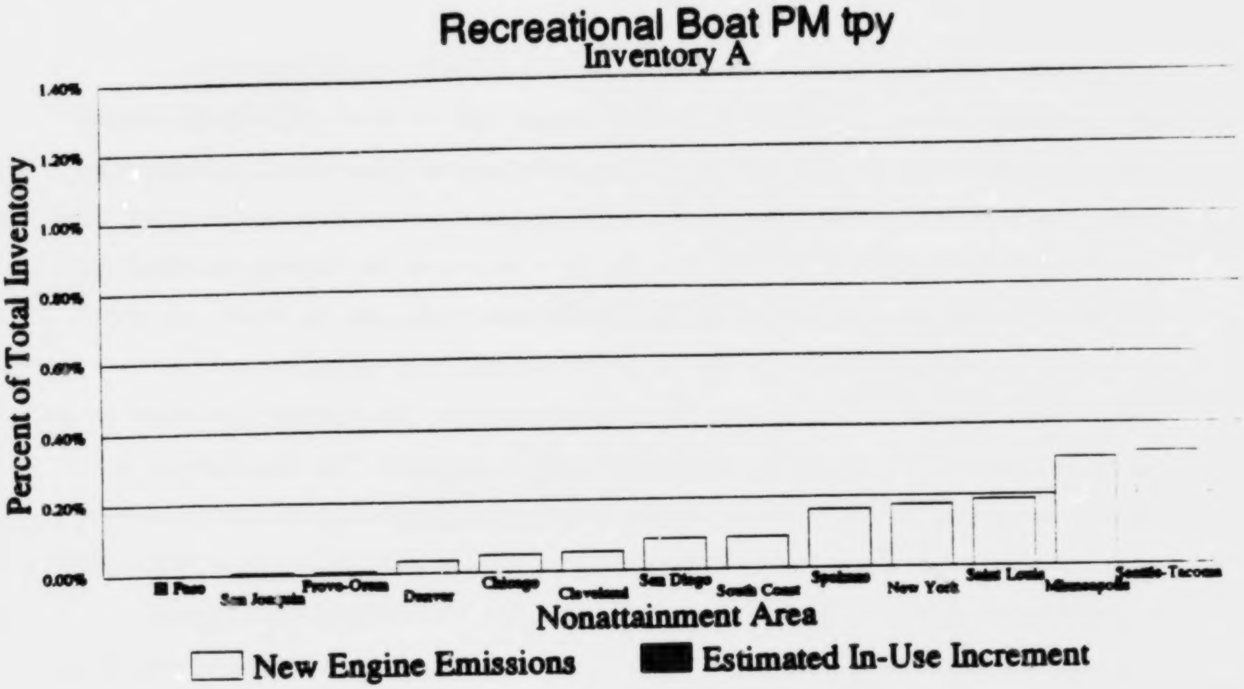
New Engine Emissions
Estimated In-Use Increment


Recreational Boats CO tpwd
Inventory B
Percent of Total Inventory
1.40%
1.20%
1.00%
0.80%
0.60%
0.40%
0.20%
0.00%
El Paso
Provo-Orem
Denver
Spokane
Cleveland
Saint Louis
Minneapolis
Washington DC
New York
San Joaquin
Hartford
Baltimore
South Coast
Boston
Seattle-Tacoma
San Diego
Nonattainment Area
New Engine Emissions
Estimated In-Use Increment


Recreational Boat PM tpy
Inventory A
Percent of Total Inventory
1.40%
1.20%
1.00%
0.80%
0.60%
0.40%
0.20%
0.00%
El Paso
San Joaquin
Provo-Orem
Denver
Chicago
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San Diego
South Coast
Spokane
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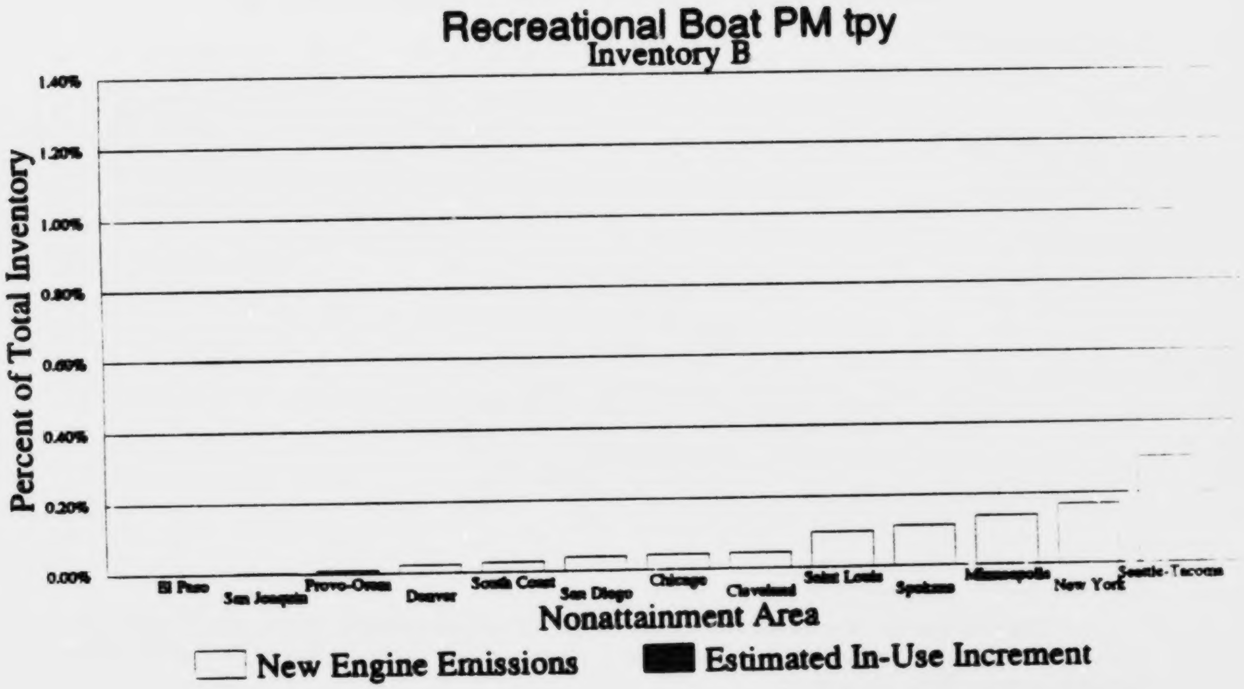
Saint Louis
Minneapolis
Seattle-Tacoma
Nonattainment Area
New Engine Emissions
Estimated In-Use Increment


Recreational Boat PM tpy
Inventory B
Percent of Total Inventory
1.40%
1.20%
1.00%
0.80%
0.60%
0.40%
0.20%
0.00%
El Paso
San Joaquin
Provo-Orem
Denver
South Coast
San Diego
Chicago
Cleveland
Saint Louis
Spokane
Minneapolis
New York
Seattle-Tacoma
Nonattainment Area
New Engine Emissions
Estimated In-Use Increment

3.3. National PM, SO_x, and Air Toxics Inventories

Table 3-02 summarizes national emission inventories for particulate matter, formaldehyde, benzene, 1,3-butadiene, gasoline vapors, and oxides of sulfur for all nonroad sources. Inventories from highway vehicles and other area and point sources are presented where available and the contribution of nonroad sources to total inventory is calculated. Due to the extremely limited availability of data for toxic inventories for highway and other area and point sources, the data in the table are from the most recent year for which data was available. Therefore, the data can only be used for approximate comparisons of the contributions from the various sources of air toxic emissions. The nonroad inventories for air toxics in Table 3-02 are the in-use adjusted Inventory A numbers. The formaldehyde and benzene inventories for highway and other area and point sources were taken from an EPA technical report by P. Carey.[10] The PM and SO_X inventories were derived from EPA's 1989 emission trends report.[11] The highway vehicle value for 1,3-butadiene was based on assuming that this toxic accounted for 0.35% of the total exhaust hydrocarbons emitted from highway vehicles.[12] The aldehyde emission factors used in this study for nonroad sources are in terms of total aldehydes. To compare formaldehyde inventories from nonroad to other sources, EPA assumed that 60% of the total nonroad aldehyde emissions were formaldehyde.[*******]

[*******] The 60% estimate was typical for engines which had separate formaldehyde, as well as total aldehyde, emission measurements reported in *Nonroad Emission Factors of Air Toxics* by Melvin N. Ingalls, Southwest Research Institute, SwRI 08-3426-005.

Table 3-02. Air Toxics Emission Inventories

Toxic	Nonroad Sources		Highway Sources		Other Area And Point Sources		Total tpy
	tpy	% of Total	tpy	% of Total	tpy	% of Total	
particulate*	457,396	5.55	1,397,738	16.96	6,384,620	77.49	8,239.754
formaldehyde	41,663	13.05	74,961	23.48	202.670	63.47	319.294
benzene	109,783	25.37	275,579	63.68	47,400	10.95	432,762
1.3-butadiene	47,816		9,869				
gasoline vapors	237,048**		2,819,727				
SO_x	230,495	0.99	652,572	2.81	22,311,998	96.19	23,195.065

* Does not include fugitive dust from unpaved roads and airstrips which accounts for about 77% of total suspended particles.

** Does not include running losses or hot soak evaporative emissions.

3.4. SIP and CARB Inventory Analysis

As discussed in Chapter 2, inventories were prepared using data from SIPs and CARB analyses. The following tables summarize the results from the SIP- and CARB-based inventories. It should be noted that the emission factors used to develop SIP- and CARB-based inventories do not include in-use or transient operation adjustments. A discussion of the emission factors used to develop these inventories can be found in Appendix I. A discussion of the methodology used to create these inventories and a more detailed report of the results can be found in Appendix G.

Table 3-03. SIP-Based Inventory Summary

CMSA/NECMA	VOC		NO_x		CO	
	tpy (%)	tpsd (%)	tpy (%)	tpsd (%)	tpy (%)	tpwd (%)
Atlanta, GA	3	4	7	8		
Beaumont-Port Arthur, TX		1		18		
Boston, MA		6		9		6
Chicago, Il		5		7.6		
Connecticut		10		21		4
Dallas, TX		4		14		
Denver, CO						3
Duluth, MN					6	
El Paso, TX		3		18		
Fort Collins, CO						4
Hartford, CT		7		25		4
Houston, TX		4		6		
Louisville, KY		12		44		
Minneapolis, MN					16	
New Jersey	6		13		16	
Seattle, WA					9	
Springfield, MA		12		9		
State of Mass.		8		8	6	

Table 3-04. CARB-Based Inventory Summary

Air Basin	VOC tpsd (%)	NO_x tpsd (%)	CO tpwd (%)
Mountain Counties	5	31	6
Sacramento Valley	4	19	10
San Diego	3	29	10
San Francisco Bay Area	2	21	11
San Joaquin	2	13	13
South Central Coast	2	13	12
South Coast	3	17	11

Chapter 4. Discussion and Analysis of Results

Chapter 3 presented a summary of the inventories calculated from the data collected for this study. This chapter contains EPA's analysis of these inventories and its interpretation of the results. Specifically, the first section contains an analysis of nonroad contributions to total emissions by pollutant and equipment categories. A discussion of the methodologies used to calculate the inventories and their potential impact on the results is presented in the second section. Last, the contribution of nonroad emissions is compared to other categories that are currently regulated.

4.1. Discussion of Inventory Results

Following are discussions of the results for emissions of VOC, NO_x, CO, and other pollutants, and the relative contribution of equipment categories. The overall nonroad emission contributions are summarized by pollutant.

4.1.1. Volatile Organic Compounds (VOC) Inventories

Both Inventory A and Inventory B estimate that substantial summertime VOC emissions derive from nonroad sources. Inventory A estimates that 18 of the 19 ozone nonattainment areas examined have nonroad contributions over 6-9% (lower limit represents new engine and upper limit represents in-use emission factors) of total summertime VOC inventories, with a median contribution of 9.1-12.6%. The estimates in Inventory B are about 15-20% lower than those in Inventory A. However, Inventory B still estimates that 14 of the 19 areas have nonroad contributions over 6-9%, with a median contribution of 7.4-10.3%.

The largest contributors to nonroad VOC emissions are the lawn and garden and recreational marine categories. In Inventory A, the median contribution of lawn and garden equipment to total summertime VOC inventories is 2.7-4.7%, with the lowest reported contribution being 1.1-1.9%. Inventory B is slightly lower, on average, with estimates of the median lawn and garden contribution at 2.4-4.2%, and 18 areas above 1.1-1.9%.

Contributions of recreational marine equipment to nonroad VOC emissions are similar to lawn and garden contributions. Inventory A estimates the median contribution of recreation marine equipment to be 3.4-4.0%, with 15 of the 19 areas above 2%. Inventory B estimates are about a third lower, overall, but still estimates a median contribution of 2.2-2.5%, with 10 of the 19 areas above 2%.

The light commercial and construction categories each contribute at least 0.5% of total summertime inventories in 17 of the 19 nonattainment areas. Table 4-01 shows the number of nonattainment areas in which the equipment category listed contributes at least 1% of the VOC inventory.

Table 4-01. Equipment Categories Contributing at least 1% of Total Summertime VOC Inventory

Equipment Category	Number of Areas	
	Inventory A	Inventory B
Lawn and Garden	19	18-19
Recreational Equipment	2-3	0-2
Recreational Marine	17	17
Light Commercial	2-11	2-12
Construction	11-14	5-6
Agricultural	1	1
Commercial Marine	1	1

It should be noted that exhaust emissions account for less than three-quarters of the total VOC emissions from the lawn and garden category. The remaining VOC emissions from this category are due to crankcase, evaporative, and refueling spillage emissions. Spillage during refueling of the equipment is estimated to contribute 7.5% of the total lawn and garden VOC inventories and 8.9% of the lawnmower VOC inventories.

4.1.2. Nitrogen Oxide (NO_X) Inventories

Total summertime NO_X emissions from nonroad sources are estimated to be larger, as a percentage of total emissions, than nonroad VOC emissions. Nonroad NO_X emissions in all of the ozone nonattainment areas in Inventory A are estimated to be greater than 12% of the total summertime NO_X inventory, with a median contribution of 17.3%. Although lower, Inventory B still estimates that nonroad emissions contribute over 11% of total summertime NO_X emissions in 16 of the 19 nonattainment areas studied, with a median contribution of 14.5%.

Construction equipment is the largest contributor to nonroad NO_X emissions in 17 of the 19 nonattainment areas studied. Inventory A estimates that construction equipment contributes at least 6.4% of total summertime NO_X emissions in each area, with a median contribution of 9.7%. Inventory B is more than 15% lower, but still estimates that 15 of the 19 areas have construction equipment contributions of over 5%, with a median contribution of 8.4%.

NO_X contributions from airport service equipment, industrial equipment, and agricultural equipment are each estimated to be at least 1% in most of the nonattainment areas studied. However, only in one case (agricultural equipment in the San Joaquin Valley) does the contribution from any of these categories exceed 3.6% in any nonattainment area. The commercial marine vessel contributions are more variable, with larger contributions in a limited number of areas. The inventories estimate contributions of over 4% in three nonattainment areas for the commercial marine category. Table 4-02 shows the number of nonattainment areas in which the category listed contributes at least 1% of the NO_X inventory.

Table 4-02. Equipment Categories Contributing at least 1% of Total Summertime NO_x Inventory

Equipment Category	Number of Areas	
	Inventory A	Inventory B
Airport Service Equipment	12	12
Recreational Marine	2	1
Industrial	13	13
Construction	19	19
Agricultural	12	13
Commercial Marine	10	9

4.1.3. Carbon Monoxide (CO) Inventories

Inventory A estimates that nonroad emissions contribute at least 9-12% of total wintertime CO emissions in 7 of the 16 CO nonattainment areas studied, with a median contribution of 5.9-9.4%. Although slightly lower, with a median contribution of 5.2-8.5%, Inventory B estimates that nonroad emissions contribute at least 6.9-10.5% of total wintertime CO emissions in 6 areas.

Unlike nonroad emission contributions to VOC and NO_x, the nonroad emission contribution to CO is not dominated by any one or two equipment categories. The lawn and garden, light commercial, industrial, recreational, and commercial marine equipment categories each contribute a minimum of 1.4-2.2% of total wintertime CO emissions in at least 2 nonattainment areas. The single largest nonroad contributor to winter CO emissions is light commercial equipment. Both Inventory A and Inventory B estimate that this category contributes at least 2.0-3.6% of total emissions in 8 of the 16 nonattainment areas studied. Table 4-03 shows the number of nonattainment areas in which the category listed contributes at least 1% of the CO inventory.

Table 4-03. Equipment Categories Contributing at least 1% of Total Wintertime CO Inventory

Equipment Category	Number of Areas	
	Inventory A	Inventory B
Lawn and Garden	5-9	3-6
Recreational Equipment	3-7	2-5
Commercial Marine	2	2
Light Commercial	15	15
Industrial	12-13	10-11
Construction	3-4	0-1

4.1.4. Particulate (PM) Inventories

Inventory A estimates that nonroad emissions contribute over 3% of total PM inventories in 2 of the 13 PM nonattainment areas studied, with a median contribution of 1.8%. Inventory B is substantially lower, with a median contribution of about 1.0%, and only estimates that 1 area has nonroad contributions of over 3%.

Table 4-04 shows the number of nonattainment areas in which the category listed contributes at least 1% of the PM inventory.

Table 4-04. Equipment Categories Contributing at least 1% of Total PM Inventory

Equipment Category	Number of Areas	
	Inventory A	Inventory B
Construction	2	0
Commercial Marine	1	1

4.1.5. National Air Toxics Inventories

Section 3.3 presented estimates of toxic emissions from nonroad sources (Table 3-02). The limited availability of toxic emission data for nonroad sources made it difficult to quantify precisely the inventory from these sources. Uncertainties also exist as to the health effects (example: number of cancer incidences per year) of toxic emissions. A summary table of cancer risk estimates for air toxics is provided in Table 4-05. In this section, PM is treated as a toxic emission because of its long-term health effects (carcinogenicity) and its status as a criteria pollutant.

A rough approximation of the cancer risk from nonroad toxic emissions relative to highway toxic emissions can be determined from the ratio of nonroad inventory to highway inventory which is derived from Table 3-02. Table 4-06 shows the ratio using this method for 1986. These risk estimates are intended to be used to rank the nonroad toxic pollutants and should not be viewed as actual numbers of cancer cases per year. In addition, the model used to derive the values in Table 4-05 was developed for national highway vehicles which are more likely to be used in populated urban areas than nonroad engines and vehicles on a national level. Therefore, the accuracy of the nonroad estimates is dependent on the differences in urban/rural usage of on-highway vehicles and nonroad equipment.

Table 4.05. Summary of Risk Estimates from Motor Vehicle Air Toxics.*[††††††††]

Motor Vehicle Pollutant	U.S. Cancer Incidences/Year**		
	1986	1995	2005
1,3-butadiene	236-269	139-172	144-171
Diesel Particulate	178-860	106-662	104-518
Benzene	100-155	60-107	67-114
Formaldehyde	46-86	24-43	27-48
Gasoline Vapors	17-68	24-95	30-119
Asbestos	5-33	ND***	ND
Acetaldehyde	2	1	1
Gasoline Particulate	1-176	1-156	1-146
Ethylene Dibromide	1	< 1	< 1
Cadmium	< 1	< 1	< 1
Dioxins	ND	ND	ND
Vehicle Interior Emissions	ND	ND	ND

* The risk estimates are 95% upper confidence limits.

** The risk estimates for asbestos, cadmium and ethylene dibromide are for urban exposure only. Risks for the other pollutants include both urban and rural exposure.

*** ND = Not Determined.

[††††††††] The risk estimates are upper bound estimates; therefore, they are not intended to represent actual numbers of cancer cases but rather can be used to rank the mobile source pollutants and to guide further study. Table taken from "Air Toxics Emissions and Health Risks from Motor Vehicles," presented by J.M. Adler and P.M. Carey at the AWMA Annual Meeting, 1989.

Table 4-06. Risk Estimates for Nonroad Toxic Emissions.

Nonroad/Highway Inventory Ratio	
1,3-Butadiene	4.85
Particulates	0.33
Benzene	0.40
Formaldehyde	0.56

As Table 4-06 shows, 1,3-butadiene cancer risk estimates are extremely high for nonroad sources compared to on-highway sources. This is due primarily to two factors. The first factor relates to emission levels of 1,3-butadiene and the use of catalysts. Most on-highway vehicles use catalysts and have 1,3-butadiene emissions that are about 0.35% of total exhaust emissions. In comparison, few nonroad engines are so equipped, and as a result, have 1,3-butadiene emissions that comprise about 1.3% of total exhaust hydrocarbons. Further discussion of this difference is found in Appendix I. The second factor relates to crankcase use. While the majority of on-highway vehicles use a closed crankcase system, most nonroad engines do not and, as a result, have higher 1,3-butadiene emissions.

Many toxics such as benzene, 1,3-butadiene, aldehydes, and gasoline vapors are included in the broad category of pollutants referred to as volatile organic compounds (VOCs). Measures to control VOC emissions should reduce emissions of these air toxics. However, the magnitude of reduction will depend on whether the control technology reduces the individual toxics in the same proportion that total VOCs are reduced.

As evidenced by the 1990 Clean Air Act Amendments, Congress recognized the need to study and regulate emissions of air toxics from motor vehicles and fuels. The Amendments require that EPA complete a study of emissions that pose the greatest risk to human health or about which significant uncertainties remain by May 15, 1992. Also, EPA must promulgate vehicle or fuel standards containing reasonable requirements to control toxic emissions, applying at the minimum to benzene and formaldehyde, by May 15, 1995.

4.2. Analysis of Inventory Methodologies

As outlined in Chapter 2, many of the inputs used to generate Inventory A and Inventory B are based upon different sources of information. This section discusses the effect that these differences could have on the inventory estimates. The results of this study could also be affected by methodologies which overestimate or underestimate emission inventories, as well as factors such as photochemical modeling, nonseasonal temporal adjustments, photochemical reactivity and transport. The potential impact of these factors on emission inventories is also discussed in this section.

4.2.1. Data Differences

The results and analysis presented in Chapters 3 and 4 reveal that Inventory A generally estimates higher nonroad emissions than Inventory B. This difference in emissions is primarily due to different local amounts of boat usage and annual fuel consumption estimates for the recreational marine category, activity level estimates for lawnmowers and population estimates for the construction category. The following highlights the differences in each category.

Lawn and Garden Equipment--Both the Outdoor Power Equipment Institute (OPEI) and the Portable Power Equipment Manufacturers Association (PPEMA) submitted local and national population estimates, annual hours of use, average horsepower, and load factors for lawn and garden equipment. This data was used to estimate the emissions inventory for Inventory B. Although there are several differences between the national populations, annual hours of use, average horsepowers, and load factors for lawn and garden equipment in Inventories A and B, these tend to offset one another in most cases, resulting in similar estimates of emissions from most lawn and garden equipment. The primary exception is lawnmowers. Inventory A estimates for lawnmower populations, annual hours of use, horsepower, and load factor are higher than those for Inventory B by 10%, 20%, 5%, and 20%, respectively, leading to activity level estimates for Inventory A that are, in general, about 70% higher than for Inventory B. Overall, Inventory A estimates lawn and garden emissions that are about 10-15% higher than Inventory B.

Recreational Equipment--The Motorcycle Industry Council (MIC) submitted survey results for actual miles driven and seasonal activity for off-road motorcycles and all-terrain vehicles. The seasonal activity levels were used by EPA to make seasonal adjustments for both inventories. The International Snowmobile Industry Association (ISIA) submitted national population and annual hours of use estimates for snowmobiles. The only substantial difference between Inventories A and B, is the latter's lower annual usage estimates. While this caused Inventory B's emission estimates from recreational equipment to be significantly lower than Inventory A's, the impact on total nonroad emissions is small due to the relatively low contribution of the category.

Recreational Marine--Both inventories used local boat registration data as the basis for making population estimates. However, the methods of allocating the number of boats actually used in the nonattainment areas differ significantly. Inventory A relies on survey results submitted by the National Marine Manufacturers Association (NMMA) from eight nonattainment areas to establish the ratio of boats used to boats registered in the nonattainment area. For Inventory B, NMMA supplied a method of estimating the ratio of boats used to boats registered based on the amount of water surface area in the nonattainment are per registered boat. The methodology used for Inventory B yields estimates of boat usage in the nonattainment areas that are about 10% lower than those in Inventory A. Another factor accounting for the difference between the two inventories is the estimate of annual gallons of fuel consumed. The average fuel use calculated for Inventory A from annual hour of use, average horsepower, and load factor estimates is very similar to the fuel use survey results reported by NMMA. However, NMMA believes that the reported fuel use in the survey is overstated. Thus, for Inventory B, EPA adjusted the average amount of fuel reported in the survey by the ratio of a national average fuel use calculation for outboard motors, 91 gallons/year, to the average reported in the NMMA survey for outboard motors, 142 gallons/year, before applying the results to the unsurveyed areas. Overall, emission estimates in Inventory B are about a third lower than those in Inventory A.

Industrial--The Industrial Truck Association (ITA) submitted population, annual hours of use, load factor, and engine type estimates for forklifts. The load factor estimates were adopted by EPA for both inventories. Overall, ITA's estimates yield emission inventory estimates substantially lower than the forklift estimates in Inventory A, primarily due to much lower annual hours of use estimates. Due to the relatively small amount of emissions from forklifts compared to some other equipment types, the impact on the overall NO_X inventory was less than 3% (the impact on the VOC and CO inventories is much lower yet). No information was submitted by industry for the other equipment types in this category.

Construction--Equipment Manufacturers Institute (EMI) submitted national horsepower, national load factor, regional hours of use, and regional population estimates for most of the equipment types in this category. Overall, the horsepower, load factor, and annual hours of use estimates are similar to the estimates used in Inventory A. However, EMI's population estimates are lower than those in Inventory A.

Agricultural, Airport Service, Light Commercial, Logging, and Commercial Marine--No substantial amount of information was submitted by industry for these equipment categories.

4.2.2. Factors Causing Overestimation or Underestimation

EPA had sufficient information in several areas to know that methodologies used to quantify emission inventories could tend to overstate or understate the actual inventories. Where sufficient data was available to quantify the bias, corrections were incorporated into the data used for the inventories developed for this study. However, in some cases, which are discussed in this section, sufficient data was not available to make adjustments.

The estimates used for NO_X emissions from highway vehicles and other area and point sources are taken from the 1985 National Emission Report. While more recent NO_X data is available on the national level, no general source of local NO_X emissions is available after 1985. The level of emissions from highway vehicles in 1990 is actually somewhat lower due to the replacement of older vehicles with new vehicles having more effective emission controls.[‡‡‡‡‡‡‡] In this study, use of the 1985 data has the effect of overestimating NO_X emissions from other sources and, hence, underestimating the proportion of NO_X emissions from nonroad engines.

[‡‡‡‡‡‡‡] Based on *National Air Pollutant Emission Estimates: 1940-1989*, highway NO_X emissions dropped 16% between 1985 and 1989.

No estimates of emissions from personal watercraft (e.g., Jet Skis) are included in this study due to lack of data. PSR does not compile information on personal watercraft and the survey conducted by Irwin Broh and Associates for NMMA contained numerous cases where the respondent obviously misunderstood the category. This omission has the effect of slightly understating the inventory estimates.

The emission factors developed by EPA for this study include new and more extensive test data than previously incorporated into emission factor estimates. For the first time, the emission factors also consider evaporative and refueling emissions. In addition, in-use deterioration estimates were incorporated into a second set of emission estimates for each inventory. Nevertheless, the potential for inaccuracies still exist due to lack of data in some areas.

Factors that may cause the emission factors and, hence, the inventories to be understated are:

- Spillage factor. Application of the spillage factor for on-highway vehicles to large nonroad engines could result in underestimation of emission factors, since on-highway users are likely to be more conscious of spilling fuel on themselves and/or damaging the car's finish. Further, spillage from all equipment is likely to be underestimated due to the fact that all refuelings were assumed to be complete fill-ups.

- Evaporative emissions. The absence of data on hot soak or running loss emissions for nonroad vehicles and vapor displacement for gas can refueling may have resulted in underestimation of total evaporative emissions.

- Wintertime CO emissions. All emission factor testing has occurred at typical summertime temperatures (roughly 75°F). CO emissions, however, increase at colder temperatures due to additional fuel enrichment and longer warmup times. This effect was not accounted for in the determination of CO tpwd for nonroad engines due to lack of data. The proportion of cold start operation on nonroad engines is unknown, but is likely to be much lower than for automobiles due to the tendency for most nonroad engines to be used for extended periods of time. It should be noted that the on-highway mobile source inventories used to determine the relative contribution of nonroad emissions did include the effect of wintertime temperatures on emissions.

- Crankcase CO and NO_x emissions. Exclusion of crankcase CO and NO_x emissions could result in slight underestimation of nonroad emissions, even though their contribution is relatively small.

4.2.3. Additional Considerations

Several factors that could potentially offset the contribution of nonroad engines to air quality nonattainment were not incorporated into this study. Some were not included because it was determined that to do so would not improve the validity of the results, while for others, insufficient information was available to develop methodologies within the timeframe mandated by Congress. This section discusses these factors, the reasons why they were excluded, and the potential impact (if any) on the results.

Non-Seasonal Temporal Adjustments--As previously discussed, EPA adjusted nonroad equipment activity levels for seasonal variation in usage. The inventories in this study are expressed in average daily emissions during summer (tpsd) and winter (tpwd), which are the seasons associated most strongly with ozone and CO nonattainment, respectively. As discussed in Appendix L, ozone and CO exceedences occur during both weekdays and weekends. Consequently, variations in source activity during the week and during the day were not considered.

Photochemical Modeling--As has been noted elsewhere in this report, the formation of ozone is an extremely complex process. It is difficult to understand the exact role played by emissions from the thousands of sources inside and upwind of a particular nonattainment area without a detailed photochemical model that takes into account not only manmade emissions but also local wind and weather patterns and biogenic emissions. Only recently have reliable photochemical models come into widespread use. The Regional Oxidant Model (ROM) for large, multi-state areas and the Urban Airshed Model (UAM) for individual urban areas represent the state of the art in air quality modeling for attainment planning. Congress has mandated that the worst nonattainment areas use photochemical modeling as a tool in developing individual customized plans for attaining the ozone standard.

EPA has not included photochemical modeling in this study for two reasons. First, developing and calibrating these models for even one nonattainment area would not have been possible within the deadline and budget for completion of this study. Second, the detailed, localized information available from photochemical models of individual cities would have added little additional relevant information to the overall question of the importance of nonroad emissions to attainment problems nationwide. Photochemical models are useful in deciding such questions as "On the margin, which kind of additional control would be more effective in reducing ozone in a particular area, NO_X or VOC?" Thus photochemical modeling is important in severe nonattainment areas, where very large emission reductions are needed and each additional emission reduction strategy is likely to be costly. Detailed photochemical modeling of all nonattainment cities is not required to reach the conclusion that the ozone problem in urban areas across the United States is serious and attainment of the ozone standard will require large reductions of both VOC and NO_X emissions nationwide; that conclusion has already been reached in the establishment of the CAA itself. The photochemical modeling of alternative emission control strategies contained in the recent ROMNET report[13] offers additional support: ROMNET found that reductions in both VOC and NO_X emissions beyond the minimum requirements of the CAA and across the northeastern U.S. would be required to bring the major East Coast cities into attainment of the ozone standard. Thus, EPA is satisfied that if nonroad sources are found to be a significant contributor of either NO_X or VOCs, then they are a significant contributor to nonattainment of the ozone standard.

Photochemical Reactivity--An issue related to photochemical modeling is whether nonroad VOC emissions are, on average, more or less photochemically reactive than emissions from other sources. As is evident from the discussion of toxic emissions from nonroad engines, very little data exists on the amount of individual species of VOCs emitted by nonroad engines. For the purposes of this study, EPA has assumed that the photochemical reactivity of nonroad VOC emissions is the same, on average, as VOC emissions from other sources. This is a reasonable assumption given that most nonroad engines are related to on-highway engines and that on-highway engines are the single most important source of VOC emissions in nonattainment areas.

Transport--During the past few years, it has become more apparent that ozone is a regional and not a local air quality problem. Recent studies [14] [15] [16] have shown that ozone and ozone precursors can travel long distances and affect air quality in areas at least two hundred miles from the source of ozone-forming emissions under some circumstances. Obviously, ozone does not respect the political boundaries enclosed by city, county, state, or nonattainment area lines.

Ozone transport complicates the assessment of nonroad emission contribution to urban nonattainment. To keep this study to a manageable size, EPA decided to include only equipment usage within the nonattainment areas in the inventory estimates. However, EPA is aware that emissions from equipment outside the nonattainment area boundaries also will affect the ozone level within nonattainment areas. Because emissions from equipment used outside nonattainment area boundaries may affect air quality, but are not accounted for in the inventories included here, the contribution of this equipment to urban nonattainment will be underestimated in this study. Underestimation of the air quality impact of nonroad equipment will be greatest for those types of equipment that have a substantial portion of their usage outside urban areas, such as agricultural equipment and recreational equipment (including marine pleasure craft).

It is difficult to quantify the underestimation of the nonroad impact on urban nonattainment that is due to transport for several reasons. First, EPA does not have current detailed information on nonroad populations and usage rates outside the areas considered in this study. County-by-county inventories for nonroad equipment are contained in national emission data bases, such as the inventories used in the National Acid Precipitation Assessment Program (NAPAP), but these inventories are at a rather broad level of categorization (such as "nonroad-diesel"), and use some obsolete emission factors. Second, it is difficult to estimate exactly what proportion of the emissions outside nonattainment areas affect nonattainment area air quality. It would seem reasonable to assume that emissions from sources 50 miles from a nonattainment area would have a greater impact than an identical source 150 miles from the nonattainment area, but currently no accepted "distance discount factor" is available that could be applied to inventories outside nonattainment areas.

Third, the impact of transported emissions in any given area may vary considerably with meteorological conditions, particularly wind speed and direction. A study of transport in California found that, in some air basins, transport may have an "overwhelming" impact on ozone levels under one set of meteorological conditions, but an "inconsequential" impact under another set of meteorological conditions. Finally, local topography would be expected to influence the pattern and importance of transport in different areas. Transport characteristics in a nonattainment area surrounded by mountains and valleys would be different from those in nonattainment areas surrounded by flat land.

To adequately assess the impact of transport on individual areas, detailed regional oxidant models (ROMs) must be constructed. These models include thousands of parameters, such as spatially distributed emission inventories for manmade and biogenic emissions over a wide area, detailed meteorological data, and topographical characteristics. Construction of these models was beyond the scope of this study. However, EPA's Office of Air Quality Planning and Standards, in association with EPA regions and state authorities, has recently completed a five-year study of transport and ozone formation in the Northeast, the Regional Oxidant Model for Northeast Transport (ROMNET). ROMNET concluded that emissions outside the heavily urbanized northeast coastal "Corridor" contributed to nonattainment in the Corridor. The ROMNET report states: "The results suggest that without stringent upwind controls, ozone levels in parts of the Corridor may not be reduced to below the concentration specified in the NAAQS even with stringent controls along the entire length of the Corridor." (p. ES-11).

The ROMNET inventories and modeling results may be used to make an "order-of-magnitude" assessment of the potential impact of transported nonroad emissions on nonattainment. By looking at the effect of reducing upwind emission inventories on ozone levels in particular nonattainment areas and at the proportion of nonroad emissions in the upwind inventories, a rough estimate of the impact of transported nonroad emissions on these cities under one set of meteorological conditions may be obtained. According to control measure simulations in the ROMNET study, a reduction of 65% of the non-Corridor VOC inventory and 60% of the non-Corridor NO_x inventory resulted in an average peak ozone reduction of 8.6 ppb in the Corridor as a whole and 11.5 ppb average peak ozone reduction in the nonattainment areas of Washington/Baltimore and Philadelphia. This implies that 1% of the non-Corridor VOC and NO_x inventories account for 0.14 ppb of the peak ozone concentration in the Corridor cities on average and about 0.18 ppb of the peak ozone concentration in the Washington/Baltimore and Philadelphia areas. The ROMNET Study assumed that nonroad engines accounted for 2.3% of the non-Corridor VOC inventory and 4.4% of the non-Corridor NO_x inventory in 1985. Very roughly, this implies that transported pollutants from nonroad sources account for 0.5 ppb of the peak ozone concentrations in the Corridor cities as a whole and 0.6 ppb of the peak ozone concentration in the Baltimore/ Washington and Philadelphia areas under the meteorological conditions modeled. If nonroad sources are not controlled, transported pollutants from non-Corridor nonroad sources would account for roughly 0.3-0.45% of the ozone level along the East Coast during nonattainment episodes after implementation of the other measures in the 1990 CAAA. These estimates are not included in the estimates of the impact of nonroad emissions on urban nonattainment in the rest of this report, because they were available for only a few cities under specific circumstances and because the ROMNET nonroad emission estimates are likely to be greatly understated.

EPA and state and local air quality authorities are continuing their study of the impact of transported emissions on urban nonattainment. Efforts are currently underway to further characterize ozone formation and transport in the Northeast, and comprehensive ROMs covering the Midwest and Southeast are also planned. A comprehensive study of ozone transport in the Lake Michigan area has been launched by EPA's Region V and the states surrounding Lake Michigan.

A more complete description of existing transport studies is contained in Appendix P.

4.3. Analysis of Nonroad Emission Impact

A great deal of effort and money has been expended on reducing emissions from a wide variety of sources, from the automobile to area sources such as dry cleaning and bakeries. The CAAA of 1990 mandate additional controls in many areas and more stringent controls on most of the equipment currently regulated. The purpose of this section is to help put the nonroad emission contribution into context by comparing nonroad emissions to currently regulated sources.

The nonroad emission inventories developed for this study estimate that the median nonroad contribution to total VOC and NO_x emissions for the nonattainment areas studied is over 7% for VOC and over 14% for NO_x. Based on emission inventories for all sources given in *National Air Pollutant Emission Estimates: 1940-1989*, the only source categories with larger VOC contributions at the national level are on-highway mobile sources and solvent evaporation. Also at the national level, the only source categories with greater NO_x contributions are on-highway mobile sources and electrical generation. Among the source categories with lower estimated contributions are industrial combustion, industrial processes, petroleum refining, and petroleum product storage and transfer. All of these other source categories are currently subject to emission control regulations. The estimated contributions of these categories are presented in Table 4-07.

Table 4-07. Contribution to Total Inventory

Pollutant	Source Category	% contribution[‡‡‡‡‡‡‡]
VOC	On-highway Mobile	25
	Solvent Evaporation	24
	Nonroad	7-13
	Petroleum Refining	3
	Petroleum Product Storage and Transfer	7
NO_x	On-highway Mobile	29
	Electrical Generation	32
	Nonroad	14-17
	Industrial Combustion	14
	Industrial Processes	3

Another comparison of nonroad emissions to other sources can be made by examining the 1990 CAAA requirements for Reasonably Available Control Technology (RACT) on stationary sources. RACT controls will now be required on all stationary sources with either VOC or NO_x emission above 50 tpy in serious nonattainment areas, 25 tpy in severe areas,

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[‡‡‡‡‡‡‡] Nonroad based on median contribution determined by this study; ranges reflect the largest and smallest local contributions calculated by Inventories A and B with new engine and in-use emission factors. All other contribution estimates are based on data from *National Air Pollution Emission Estimates: 1940-1989*, and are given at the national level for 1989.

and 10 tpy in extreme areas. This means, for example, that an area designated as an extreme ozone nonattainment area is required to install RACT control on every stationary source over 10 tpy. By comparison, Table 4-08 provides the number of new vehicles or pieces of equipment that it would take to generate 10 tpy, based on their typical yearly operation. For the nonroad sources, the chart indicates the range between data used to develop A and B national inventories.

Table 4-08. Comparison of Ozone Precursor Emissions from Various Vehicles and Equipment

Vehicles or Equipment	No. for 10 tpy
Off-highway trucks	1.6-2.1
Crawler tractors	10
On-highway heavy-duty diesel truck*	20
Agricultural tractors	24
Boats with outboard motors	74-142
Passenger Cars*	700
Chain saws	730-1,630
Lawnmowers	1,680-2,380
String trimmers	2,810-4,630

* Based on first-year emissions of a current technology vehicle.

Because CO nonattainment is usually more localized than ozone nonattainment, comparisons of national CO emissions may be misleading. A comparison of nonroad and highway CO emissions may, however, be made at the local level. Inventories developed for this study indicate that the median nonroad contribution to local wintertime CO emissions ranged from 5.2% to 9.4%, while the median contribution from highway vehicles was 81%.

Chapter 5. Conclusions

A significant quantity of new information was generated by CARB, EPA, EPA contractors, and the industry in response to California's proposed nonroad regulations and this study. EPA used this new information and existing data to develop Inventories A and B. As a result, these inventories provide a more comprehensive picture of nonroad emission contributions to VOC, NO_x, CO and PM, than previously available. Among the findings of this study are the following:

1. Median nonroad contributions to the total emission inventory for the 24 areas are estimated to be:

	VOC (%)	NO_x (%)	CO (%)	PM (%)
Inventory A	9.1-12.6	17.3	5.9-9.4	1.8
Inventory B	7.3-10.3	14.5	5.2-8.5	1.0

2. Congress mandated that EPA study emissions from nonroad sources to determine whether such emissions cause or significantly contribute to air quality problems, and in particular whether they are contributors to ozone or CO concentrations in more than one CO or ozone nonattainment area. Of the nonattainment areas studied, the second highest contribution to total inventories from nonroad engines and vehicles for VOC, NO_x, and CO is as follows:

	VOC (%)	NO_x (%)	CO (%)
Inventory A	13.1-18.7	29.3	9.0-14.2
Inventory B	11.4-16.0	31.1	8.5-13.3

3. The results discussed throughout this report do not include the transport of ozone into the nonattainment areas. The effect of ozone transport would be to increase the emission contribution of typically nonurban equipment, such as agricultural,

recreational marine, and logging equipment. While this effect may be relatively small, it is not insignificant.

4. Only on-highway vehicles, electric generation, and solvent evaporation have NO_x and/or VOC emissions that exceed those of nonroad equipment.

Recommendations for Inventory Improvements

The study identified a number of areas where inventory estimates could be affected by the absence of data or the use of limited information. Nonroad inventory estimates could be enhanced by collection of additional data, particularly in the area of emission factors. For example, existing nonroad emission data allows an adequate assessment of tailpipe emissions from relatively new engines. More information, however, is needed to quantify other types of emissions, such as evaporative, crankcase, and toxic emissions, and the effect of in-use deterioration. Specifically, data should be obtained for the following areas:

1. In-use emissions. Additional testing needs to be conducted on in-use engines to further quantify the effects of deterioration on the different types of nonroad engines.

2. Hot soak and running loss evaporative emissions. Currently, no hot soak and running loss evaporative emission data exist for nonroad engines. Such emissions are substantial for on-highway vehicles and can vary significantly according to the type of equipment on which an engine is installed. Therefore, tests should be conducted to determine whether these emissions from nonroad equipment need to be controlled.

3. Toxic emissions. EPA used the limited data that was available on toxic emission from nonroad engines to make the assumptions regarding such emissions. Such assumptions, particularly those for 1,3-butadiene, should be verified through further testing.

4. Crankcase emissions. Further studies should be conducted to improve the measurement of crankcase emission levels from nonroad engines and to determine which engines use open and closed crankcases.

5. Cold start emissions. Currently, no data are available on the contribution of cold starts to nonroad emissions. Work should be undertaken to assess the proportion of cold start fuel enrichment operation on different types of nonroad equipment, and then to measure the impact of such operation on total emissions.

6. Emission data representativeness. Currently, nonroad emission data are uniformly applied to all similar nonroad engines. More accurate emission factors could be developed if emission testing were performed on engines representative of the population.

7. Cycle representativeness. Steady state test cycles do not adequately represent VOC, CO, and particulate emissions generated during in-use transient operation. To the extent that nonroad equipment encounters transient operation in-use, steady state cycles could significantly understate emissions, especially particulate matter. The adjustments made in this study to account for transient operation were based on very limited test data which applied only to diesel engines. More work should be done to assess the typical operating cycles of nonroad equipment. Such characterizations would facilitate the assessment of the amount and importance of transient operation on nonroad engines, as well as improve load factor estimates.

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PB92-126960

United States
Environmental Protection
Agency

Office of Air and Radiation
(ANR-443)
Washington, DC 20460

November 1991

Air

EPA

Nonroad Engine and Vehicle Emission Study—Appendixes

A-i

Nonroad Engine and Vehicle Emission Study

Appendixes

November 1991

Certification Division
Office of Mobile Sources
Office of Air & Radiation
U.S. Environmental Protection Agency

A-ii

Nonroad Engine and Vehicle Emission Study

List of Appendixes

The following appendixes provide background information for the Nonroad Engine and Vehicle Emission Study - Report. They are presented in their order of first occurrance in the text of the report.

Appendix A. Glossary of Acronyms and Terms
Appendix B. Ozone Formation
Appendix C. Ozone and CO Nonattainment and Air Toxic Risk Estimates
Appendix D. Mobile Source Air Toxics
Appendix E. Manufacturer Association Membership
Appendix F. Technical Review Group Representatives
Appendix G. Emission Inventories Developed Using SIP and CARB Data
Appendix H. List of Equipment Types
Appendix I. Emission Factor Development
Appendix J. Additional Data Submissions
Appendix K. Adjustments to Data in Developing Inventory A
Appendix L. Regional and Seasonal Adjustments to Inventories
Appendix M. Emission Inventory A
Appendix N. EPA Use of Manufacturer Data In Inventory B
Appendix O. Emission Inventory B
Appendix P. Transport and Nonroad Emissions
Appendix Q. Response to Public Comment

Appendix A. Glossary of Acronyms and Terms

Acronyms

The following acronyms have been used in the report or its appendixes.

AIRS	Aeromatic Information Retrieval System
AMS	Area and Mobile Source
ASTM	American Society for Testing and Materials
BY	Base Year
BSFC	Brake Specific Fuel Consumption
CAA or the Act	Clean Air Act
CAAA	Clean Air Act Amendments
CARB	California Air Resources Board
CIMA	Construction Industries Manufacturing Association
CMSA	Consolidated Metropolitan Statistical Area
CNG	Compressed Natural Gas
CO	Carbon Monoxide
CO_2	Carbon Dioxide
CTG	Control Technology Guidelines
EEA	Energy and Environmental Analysis
EMA	Engine Manufacturers Association
EMI	Equipment Manufacturers Institute
EPA	Environmental Protection Agency
HC	Hydrocarbon
hp	Horsepower
IRIS	Integrated Risk Information System
ISIA	International Snowmobile Industry Association
ITA	Industrial Truck Association
LMOS	Lake Michigan Oxidant Study
LPG	Liquified Petroleum Gas
MECA	Manufacturers of Emission Controls Association
MIC	Motorcycle Industry Council
MSA	Metropolitan Statistical Area
NMMA	National Marine Manufacturers Association
NAAQS	National Ambient Air Quality Standards
NAPAP	National Acid Precipitation Assessment Program
NECMA	New England County Metropolitan Areas
NESCAUM	Northeast States for Coordinated Air Use Management
NESHAPS	National Emissions Standards for Hazardous Air Pollutants
NO_2	Nitrogen Dioxide
NO_X	Oxides of Nitrogen
O_3	Ozone
OAR	Office of Air and Radiation
OAQPS	Office of Air Quality and Pollution Standards

ppb	parts per billion
PPEMA	Portable Power Equipment Manufacturers Association
ppm	parts per million
PSR	Power Systems Research
RACT	Reasonably Available Control Technology
ROM	Regional Oxidant Model
ROMNET	Regional Ozone Modeling for NorthEast Transport
rpm	revolutions per minute
RVP	Reid Vapor Pressure
SAE	Society of Automotive Engineers
SIP	State Implementation Plan
SEMA	Specialty Equipment Market Association
SO_2	Sulfur Dioxide
SO_x	Oxides of Sulfur
SwRI	Southwest Research Institute
TPD	Tons per Day
TPSD	Tons per Summer Day
TPWD	Tons per Winter Day
TPY	Tons per Year
TSD	Technical Support Document
TSDF	treatment, storage, and disposal facilities
UAM	Urban Airshed Model
VOC	Volatile Organic Compounds

Glossary of Terms

The following terms are defined as they were used in this report or its appendixes.

Activity level:	Unit indicating the combined effect of population, annual hours of use, average-rated horsepower, and load factor. Determined by multiplying the population x annual hours of use x horsepower x load factor. The activity level is also the product of the population and the per-source usage rate.
Airshed:	A geographical area which, because of topography, meteorology, and climate, shares the same air mass.
Air Toxic:	A compound in the air capable of causing adverse health effects. For the purpose of this report, the air toxics examined were limited to known or suspected carcinogens.
Aldehydes:	A class of fast-reacting organic compounds containing oxygen, hydrogen, and carbon. They contain the group -CHO.
Annual hours of use:	Average number of hours a given equipment type is used in one year.
Attainment area:	A region that meets the National Ambient Air Quality Standards for a criteria pollutant under the Clean Air Act.
Control technology:	A combination of measures designated to achieve the aggregate reduction of emissions.
Crankcase:	The part of the engine that surrounds the crankshaft; usually the lower section of the cylinder block.
Crankcase emissions:	Pollution emitted into the atmosphere from any portion of the engine crankcase ventilating or lubricating system.
Crankcase emission control system:	A system of passages designed to convey gases from and/or to the crankcase of an engine. The system may or may not include means to regulate the flow(s).
Criteria pollutants:	The Clean Air Act requires the Environmental Protection Agency to set air quality standards for common and widespread pollutants after preparing "criteria documents" summarizing scientific knowledge on their health effects. Today there are standards in effect for six "criteria pollutants": sulfur dioxide, carbon monoxide, particulates, nitrogen dioxide, ozone and lead.

Diurnal emissions:	Fuel vapors emitted as a result of a specified increase in fuel tank temperature in a specified time. For the purposes of this report, diurnal losses are those vapor emissions which occur while the equipment is not operating and are attributable to natural changes in ambient conditions (temperature, pressure, etc.).
Duty cycle:	The ratio of the time "on" of a device or system divided by the total cycle time (i.e., "on" plus time "off"). For a device that normally runs intermittently rather than continuously; the amount of time a device operates as opposed to its idle time.
Emission factor:	Measure of the rate at which a particular type of equipment emits a particular pollutant under normal operating conditions. Emission factors are commonly massed-based and expressed in units of mass per unit of work.
Emissions inventory:	A detailed listing of the amounts of pollution generated by different sources in an area during a specific period of time.
Evaporative emissions:	Losses due to evaporation of unburned fuel. For the purposes of this report, evaporative emissions are subdivided into four groups: hot soak, diurnal, resting loss, and running loss emissions.
4-stroke cycle:	The four-piston strokes--intake, compression, power, and exhaust--that make up the complete cycle of events in the 4-stroke-cycle engine. Also called 4-cycle and 4-stroke.
Horsepower, average rated:	The average of the maximum horsepower ratings for the engines in a given type of equipment.
Hot soak emissions:	Emissions which occur after the equipment has been turned off and attributable to the elevated temperature of the equipment (e.g., evaporation from the carburetor bowl).
Load factor:	The ratio of the engine power output during typical operating conditions to the engine rated horsepower.
National Ambient Air Quality Standards (NAAQS):	Section 109 of the Clean Air Act requires EPA to set nationwide standards, the National Ambient Air Quality Standards, for widespread air pollutants. Currently, six pollutants are regulated by primary and secondary NAAQS--carbon monoxide, lead, nitrogen dioxide, ozone, particulate matter (PM-10), and sulfur dioxide. See Criteria Pollutants.

Nonattainment area:	A region that fails to meet Clean Air Act primary ambient air standards are designated as nonattainment areas. Most major cities in the United States are nonattainment areas for one or more of the criteria pollutants. These dirty air regions are subject to strict controls to bring them into compliance with the standards.
Nonroad vehicles:	Vehicles or items of machinery that use an internal combustion engine but are not regulated as motor vehicles or airplanes under the Clean Air Act. Construction equipment is an examples of nonroad vehicles.
Per-source use rate:	Unit indicating the combined effect of annual hours of use, average-rated horsepower, and load factor. Determined by multiplying the annual hours of use by horsepower by load factor.
Population:	Total number of units of a given equipment or engine type at a given point in time.
Refueling emissions:	Hydrocarbon emissions that can occur during filling of the vehicle fuel tank. For the purposes of this report, there are two components of refueling emissions: spillage and vapor displacement.
Reid Vapor Pressure:	The vapor pressure of gasoline at 100°F(37.8°C) determined in a special bomb in the presence of a volume of air which occupies four times the volume of liquid fuel (ASTM procedure D 323).
Running loss emissions:	The emissions which do not pass through the combustion chamber while the source is in operation.
Spillage emissions:	Spillage emissions, or spillage, are those emissions resulting from spilled fuel incurred during the refueling process.
Steady state:	Constant operating conditions with no variation in fuel supply or load. A condition in which circuit values remain essentially constant, occurring after all initial transients or fluctuating conditions have settled down. Steady state exists when periodic (or constant) vehicle responses to periodic (or constant) control and/or disturbance inputs do not change over an arbitrarily long time. The motion responses in steady state are referred to as steady state responses. This definition does not require the vehicle to be operating in a straight line or on a level road surface. It can also be in a turn of constant radius or on a road surface.

Transient:	A phenomenon caused in a system by a sudden change in conditions and which persists for a relatively short time after the change.
Transient state:	Transient state exists when the motion responses, the external forces relative to the vehicle, or the control positions are changing with time.
Vapor displacement:	Vapor displacement emissions, or "displacement", are those emissions which result from displacing fuel vapors in the fuel tank with liquid fuel.
Volatile Organic Compounds (VOC):	Any compound containing carbon and hydrogen or containing carbon and hydrogen in combination with any other element which has a vapor pressure of 1.5 pounds per square inch absolute or greater under actual storage conditions.

Appendix B. Ozone Formation

This appendix provides a brief explanation of the process by which ozone is formed, followed by a list of other sources expanding on the role of NO_X and VOCs.

Description

The prediction of ozone (O_3) levels and the development of control strategies for ozone have been complicated by the fact that ozone is not directly emitted. Rather, it is formed in the lower atmosphere in the presence of sunlight through a complex series of reactions between volatile organic compounds (VOCs), oxides of nitrogen (NO_X), and ambient oxygen. The concentrations of ozone and its precursors are dynamic and nonlinear. Thus, ozone concentrations are not necessarily additive, but depend on the concentrations of all compounds involved in atmospheric chemistry. VOCs are emitted by anthropogenic sources, such as evaporation of gasoline and solvents, and by biogenic sources such as vegetation. Individual VOC species differ widely in their capacity to generate ozone. NO_X is formed primarily by combustion processes and can contribute to either the creation or destruction of ozone, depending on the amount of VOCs present.

Ozone is produced when atomic oxygen (O) reacts with molecular oxygen (O_2) in this reaction:

$$O + O_2 + M \rightarrow O_3 + M$$

where M is a third body that removes the energy of the reaction and stabilizes the O_3 molecule. The atomic oxygen necessary for this reaction is produced primarily from the photodissociation of NO_2, according to this reaction:

$$NO_2 + hv \rightarrow NO + O$$

The photon (hv) in this reaction is in the blue-violet end of the visible spectrum which, when absorbed, produces a brown color. This is why a brown haze is associated with ozone pollution, even though ozone itself is a colorless gas. In the above reactions, NO_X is involved in creating ozone.

However, in the absence of other reactants, the ozone and nitrogen oxide (NO) produced in these reactions will combine to form nitrogen dioxide and molecular oxygen:

$$NO + O_3 \rightarrow NO_2 + O_2$$

Thus, oxides of nitrogen participate in both the creation of ozone and can retard creation of ozone. Put another way, in isolation equilibrium concentrations of ozone, nitrogen dioxide, and nitrogen oxide coexist. However, in the presence of organic peroxy radicals (RO_2), which are formed by the reaction of hydroxyl radicals (OH) with VOCs, nitrogen dioxide can be regenerated from nitrogen oxide without consuming ozone, as in this reaction:

$$RO_2 + NO \rightarrow NO_2 + RO$$

Thus, the presence of VOCs in the atmosphere is crucial to allowing ozone to accumulate, instead of allowing ozone to stabilize at a relatively low concentration dictated by the equilibrium of NO and NO_2. Generally speaking, the presence of more organic peroxy radicals will allow more ozone molecules to persist in the air. The number of organic peroxy radicals formed from a single VOC varies, and thus the photochemical reactivity of VOCs varies.

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Appendix C. Ozone and CO Nonattainment and Air Toxic Risk Estimates

Two of the most persistent air quality problems in the United States are the nonattainment of National Ambient Air Quality Standards for carbon monoxide (CO) and ozone. Table C-01 lists the areas which fail to meet standards for CO and ozone. In addition to these nonattainment problems, concern regarding the risks associated with motor vehicle air toxics is increasing. The cancer risks associated with the motor vehicle pollutants of most concern are shown in Table C-02.[1]

Table C-01. Areas Not Meeting Standards for Carbon Monoxide and Ozone

Metropolitan Area	Pollutant Category	
	CO	Ozone
Albuquerque, NM	Moderate	
Anchorage, AK	Moderate	
Atlanta, GA		Serious
Atlantic City, NJ		Moderate
Bakersfield, CA		Serious
Baltimore, MD	Moderate	Severe
Baton Rouge, LA		Serious
Beaumont, Port Arthur, TX		Serious
Boston, MA	Moderate	Serious
Charleston, WV		Moderate
Charlotte, Rock Hill, Gastonia, NC-SC		Moderate
Chicago, Gary, Lake County, IL-IN-WI		Severe
Chico, CA	Moderate	
Cincinnati, Hamilton, OH-KY-IN		Moderate
Cleveland, OH	Moderate	Moderate
Colorado Springs, CO	Moderate	
Dallas, Fort Worth, TX		Moderate

Table C-01. (Continued)

Metropolitan Area	Pollutant Category	
	CO	Ozone
Dayton, Springfield, OH		Moderate
Denver, Boulder, CO	Moderate	
Detroit, Ann Arbor, MI		Moderate
Duluth, MN-WI	Moderate	
Edmonson Co., KY		Moderate
El Paso, TX	Moderate	Serious
Fairbanks, AK	Moderate	
Fort Collins, Loveland, CO	Moderate	
Fresno, CA	Moderate	Serious
Grand Rapids, MI		Moderate
Greater Connecticut	Moderate	Serious
Greensboro, Winston Salem, NC	Moderate	Moderate
Houston, Galveston, Brazoriz, TX		Severe
Huntington, Ashland, WV-KY-OH		Serious
Jefferson Co., NY		Moderate
Josephine Co., OR	Moderate	
Kewaunee Co., WI		Moderate
Klamath Co., OR (Klamath Falls)	Moderate	
Knox Co., ME		Moderate
Las Vegas, NV	Moderate	
Los Angeles, Anaheim, Riverside, CA	Serious	Extreme
Louisville, KY-IN		Moderate
Medford, OR	Moderate	
Memphis, TN-AR-MS	Moderate	Moderate
Miami, Fort Lauderdale, FL		Moderate
Milwaukee, WI		Severe

Table C-01. (Continued)

Metropolitan Area	Pollutant Category	
	CO	Ozone
Minneapolis, St.Paul, MN-WI	Moderate	
Missoula, MT	Moderate	
Modesto, CA	Moderate	Moderate
Muskegon, MI		Severe
Nashville, TN		Moderate
New York, Long Island, NY-NJ	Moderate	Severe
Parkersburg, Marietta, WV-OH		Serious
Philadelphia, PA	Moderate	Severe
Phoenix, AZ	Moderate	
Pittsburgh, Beaver Valley, PA		Moderate
Portland, ME		Moderate
Portland, Vancouver, OR-WA	Moderate	
Portsmith, Dover, Rochester, NH-ME		Serious
Providence, Pawtucket, Fall River, RI-MA		Serious
Provo-Orem, UT	Moderate	
Raleigh-Durham, NC	Moderate	Moderate
Reading, PA		Moderate
Reno, NV	Moderate	
Richmond, Petersburg, VA		Moderate
Sacramento, CA	Moderate	Serious
Salt Lake City, Ogden, UT		Moderate
San Diego, CA	Moderate	Severe
San Francisco, Oakland, San Jose, CA	Moderate	Moderate
Santa Barbara, Santa Maria, Lompoc, CA		Moderate
Seattle, Tacoma, WA	Moderate	
Sheboygan, WI		Serious

Table C-01. (Continued)

Metropolitan Area	Pollutant Category	
	CO	Ozone
Smyth Co., VA		Moderate
South Bend, Mishawaka, IN		Marginal
Spokane, WA	Moderate	
Springfield, MA		Serious
St. Louis, MO-IL		Moderate
Steubenville, Weirton, OH-WV	Serious	
Stockton, CA	Moderate	Marginal
Syracuse, NY	Moderate	
Toledo, OH		Moderate
Visalia, Tulare, Porterville, CA		Moderate
Washington, DC-MD-VA	Moderate	Serious
Winnebago, Co., WI	Serious	
Worchester, MA		Moderate

Table C-02. Summary of Risk Estimates*

Motor Vehicle Pollutant	U.S. Cancer Incidences/Year**		
	1986	1995	2005
1,3-Butadiene	236-269	139-172	144-171
Diesel Particulate	178-860	106-662	104-518
Benzene	100-155	60-107	67-114
Formaldehyde	46-86	24-43	27-48
Gasoline Vapors	17-68	24-95	30-119
Asbestos	5-33	ND***	ND
Acetaldehyde	2	1	1
Gasoline Particulate	1-176	1-156	1-146
Ethylene Dibromide	1	<1	<1
Cadmium	<1	<1	<1
Dioxins	ND	ND	ND
Vehicle Interior Emissions	ND	ND	ND

* The risk estimates are 95% upper confidence limits.

** The risk estimates for asbestos, cadmium and ethylene dibromide are for urban exposure only. Risks for the other pollutants include both urban and rural exposure.

*** ND = Not Determined.

Note: The risk estimates are upper bound estimates; therefore, they are not intended to represent actual numbers of cancer cases but rather can be used to rank the mobile source pollutants and to guide further study.

Projections do not account for the 1990 CAAA revisions. Risk estimates are currently being revised as part of the EPA study of "Mobile Source Related Air Toxics" required by Section 206 of the CAAA.

References

1. Adler, J.M., and P.M. Carey. "Air Toxics Emissions and Health Risks from Motor Vehicles," AWMA paper 89-34A.6 presented at the AWMA 82nd Annual Meeting, Anaheim, CA, June 1989. Ann Arbor, MI:U.S. Environmental Protection Agency, June 1989.

Appendix D. Mobile Source Air Toxics

This appendix provides detailed lists of air toxics of concern to human health. These lists were used to help decide which toxics to include in the *Nonroad Engine and Vehicle Emission Study*.

Table D-01. Mobile Source Related Air Toxics for EPA Study.[*]

Benzene	Metals:
Formaldehyde	Iron
Acetaldehyde	Copper
1,3-Butadiene	Selenium
Diesel Particulate	Platinum
Gasoline Particulate	Cerium
Gasoline Vapors	

Table D-02. Southwest Research Institute Recommendations.

Benzene
Formaldehyde
Acetaldehyde
1,3-Butadiene
Gasoline Vapors
Diesel Particulate
Gasoline Particulate
Iron

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[*] Included in the EPA study of "Mobile Source Related Air Toxics" required by Section 206 of the CAAA.

Table D-03. Other Motor Vehicle Toxics from Title III of the 1990 Clean Air Act Amendments.[†]

Acetonitrile	Hexane
Acrolein	Lead compounds
Acrylic acid	Manganese compounds
Carbon Disulfide	Methanol
Carbonyl sulfide	Methyl ethyl keytone
Catechol	Methyl tert. butyl ether
Chlorine	Naphthalene
Cresols/Cresylic acid	Phenol
Dibenzofurans	Polycyclic organic matter
Diethyl sulfate	Propionaldehyde
Dimethyl sulfate	Styrene
1,4-Dioxane	Toluene
Ethyl benzene	2,2,4-Trimethylpentane
Ethylene dibromide	Xylenes
Ethylene dichloride	

[†] This list compiled by the Office of Mobile Sources in preparing the EPA study required by Section 206 of the CAAA.

Appendix E. Manufacturer Association Membership

This appendix provides a short description for the primary manufacturer associations for nonroad engines and vehicles. Where available, a list of the member companies are also provided.

Industrial Truck Association

The Industrial Truck Association (ITA) is the national, not-for-profit trade association of forklift truck manufacturers and their suppliers. ITA members collectively produce and sell 90 percent of all industrial forklift trucks in the United States.

Regular Members

- Baker Material Handling Corp.
- Barrett Industrial Trucks
- Big Joe Manufacturing Co.
- Caterpillar Industrial Inc.
- Clark Material Handling, Inc.
- Crown Equipment
- Drexel Industries, Inc.
- Elwell-Parker Electric Co.
- Hyster Company
- K-D Manitou, Inc.
- Kalmar AC
- Komatsu Forklift Inc.
  - USA
  - Canada
- Mitsubishi Heavy Industries
  - USA
  - Canada
- Multiton MIC Corp.
- Nissan Indust. Equip. Co.
  - USA
  - Canada
- The Prime Mover Company (BT)
- The Raymond Corporation
- TCM America
  - USA
    - C. ITOH
    - TCM
  - Canada
    - Delval Handling
- Toyota
  - USA
  - Canada
- Yale Materials Handling Corp.

Associate Members

- Anderson Power Products
- Aquila Corporation
- Basiloid Products Corp.
- C&D Power Systems
- Cascade Corporation
- Chloride/Pilot
- Curtis Instruments, Inc.
- East Penn Mfg. Co., Inc.
- Engelhard Corporation
- Erectoweld Co., Inc.

ITA Associate Members (continued)

Exide Corporation
GNB Indust. Battery Co.
Hercules Engines, Inc.
Industrial Tires, Ltd.
K W Battery
Kenhar Products Inc.
Kurdziel Industries
Long Reach Mfg. Corp.
Prestolite Electric Inc.
Sevcon
Steel of West Virginia
Swing-Shift Mfg., Inc.
Toyoshima
Vickers, Inc.

Portable Power Equipment Manufacturers Association

The Portable Power Equipment Manufacturers Association (PPEMA) is the national, not-for-profit trade association representing the manufacturers of small engine powered off-road equipment such as chain saws, string trimmers, brush cutters, blowers, hedge trimmers, generators and cut-off saws. PPEMA's members manufacture the engines used in the final products they produce.

Members

Allied Signal
BASF Corporation
Carlton Company
Dolmar U.S.A., Inc.
Echo, Inc.
Homelite Division of Textron, Inc.
Husqvarna Forest & Garden Company
Inertia Dynamics Corporation
Kawasaki Motor Corporation, U.S.A.
Komatsu Zenoah America, Inc.
Oregon Cutting Systems, Division of Blount, Inc.
Poulan/Weed Eater
R.E. Phelon Company, Inc.
Shakespeare Monofilament Company
Shindaiwa, Inc.
Stihl, Inc.
The Toro Company
Walbro Corporation
U.S.A. Zama, Inc.

Outdoor Power Equipment Institute, Inc.

The Outdoor Power Equipment Institute (OPEI) is the national trade association representing manufacturers of consumer and commercial outdoor power equipment and their major components. OPEI members produce the following types of equipment and products: walk-behind lawnmowers; rear engine riding mowers; lawn tractors; garden tractors; walk-behind tillers; walk-behind snow throwers; commercial turf care equipment; engines/

attachments/components; shredders/grinders; lawn vacuums; flexible line trimmers; leaf blowers; log splitters; power brakes and thatchers; and lawn/edger/trimmers. In most cases, the goods manufactured by OPEI members are produced for the consumer market, and represent 86.9 percent of the U.S. market for lawn and garden equipment.

Regular Members

American Yard Products
Ariens Company Consolidated
Atlas Power Equipment
Bunton Company
John Deere Horicon Works
Dixon Industries, Inc.
Exmark Mfg., Inc.
Ferris Industries, Inc.
Garden Way, Inc.
Garden Way, Inc.-PW
Hoffco, Inc.
Homelite Div. of Textron
Honda Power Equip. Mfg., Inc.
Howard Price Turf Equipment
Ingersoll Equip. Co., Inc.
F.D. Kees Mfg. Co.
Kut-Kwick Corporation
Lambert Corporation
Lawn-Boy, Inc.
Maxim Mfg. Co.
MTD Products, Inc.
The Murray Ohio Mfg. Co.
NOMA Outdoor Products, Inc.
Power King/Div. of Support Services International
Ransomes, Inc.
Roto-Hoe
Sarlo Power Mowers, Inc.
Scag Power Equipment, Inc.
Simplicity Mfg., Inc.
Solo Incorporated
Southland Mower Corp.
Tornado Products
The Toro Company
Trailmate, Inc.
Wheeler Mfg. Co.
Yazoo Mfg., Inc.

Associate Members

Ataco Steel Products Corp.
Auburn Industries, Inc. KTC
Briggs & Stratton Corp.
Brinly-Hardy Co., Inc.
Capro, Inc.
Carlisle Tire and Rubber Co.
Dana Corporation
Delta Systems, Inc.
Dickey-John Corp.
DICO Tire, Inc.
Duramatic Products
Eaton Corporation
The Empire Plow Co., Inc.
Fisher Barton, Inc.
Geneco Mfg., (Div. of PLP)
Kelch Corporation
Kohler Company
Lund International
Michigan Seat Company
Monsanto Plastics Co.
New Hampshire Industries
Onan Corp.-Engine Division
Sauer-Sundstrand
Southern Mills, Inc.
J.W. Speaker Corporation
Tecumseh Products Company
Teledyne Total Power
Torrington Company

OPEI Associate Members (continued)

Transamerica Commercial Snapper Power
Equipment Finance Corp.
Tuff Torq Corporation
Wescon Products Company
Whirltronics, Inc.
Woods, Div. of Hesston
Yuasa-Exide Battery Corp.

Engine Manufacturers Association

The Engine Manufacturers Association (EMA) represents the manufacturers of engines for all applications other than aircraft and passenger cars. Membership includes both small and large engine manufacturers.

Members

American Honda
American Suzuki
Briggs & Stratton
Caterpillar Inc.
Cummins Engine Company
Deere & Company
Detroit Diesel Corporation
Deutz Corporation
Ford New Holland
General Electric
General Motors Corporation
Hino Motors, Ltd.
Isuzu Motors America, Inc.
Kawasaki Motors Corporation
Kohler Company
Komatsu Ltd.
Kubota Corporation
Lister-Petter, Inc.
Mack Trucks, Inc.
Mercedes-Benz Truck
Mitsubishi Engine North America, Inc.
Mitsubishi Motors America
Onan Corporation
Scania USA, Inc.
Tecumseh Products
Teledyne Total Power
Toyota Industrial Engines
Volvo GM Heavy Truck
Waukesha Engine Division Dresser
Industries
Yanmar Diesel America

Equipment Manufacturers Institute

The Equipment Manufacturers Institute (EMI) is the principal association in the United States representing manufacturers of agricultural, construction, forestry, material handling and utility equipment.

EMI Active Members

Aero-Lift Company
Agrequip, Inc.
Alamo, Group
Alfa-Laval Agri, Inc.
Allied Products Corporation
Alo USA Inc.
Alsea Industries Inc.,
Amerequip Corporation
American Coupler Systems, Inc.
American Trencher Inc.
Arts-Way Manufacturing Co.
Asplunch Mfg. Division
Auburn Consolidated Industries
Augers Unlimited, Inc.
Automatic Equipment Mfg. Co.

Babson Bros. Company
Badger-Northland Inc.
Behlem Manufacturing Co.
Bolarus Machinery Inc.
Bor-It Mfg. Company Inc.
Bou-Matic, The Dairy Equipment
  Div. of DEC Int., Inc.

Calavar Corporation
Carefift Equipment Ltd.
J I Case
Caterpillar Inc.
Charles Machine Works, Inc.
Chief Industries Inc.
Class of America, Inc.
Clay Equipment Corporation
Crenlo, Inc.
Custom Products of Litchfield

Dahmer Fork Lift Ltd.
Danuser Machine Co.
Deere & Company
Deutz-Allis Corporation
DICKEY-john Corporation
Dunbar Manufacturing Inc.

Elliott Equipment Corp
Esco Corporation
Eversman, Inc.

Farmhand, Inc.
tfi Corporation
FMC Corporation
FMC Corporation/AG Mach. Div.
FMC Corp./Food Processing
  Systems Div.
Ford New Holland Inc.
Franklin Equipment Company
Full Vision Inc.
Furukawa Distribution (Europe)

Gannon Manufacturing Co.
Gehl Company
General Cable Company
Genie Industries
Gradall Company
Great Bend Manufacturing Co.
Gregory Manufacturing Company
Grove Worldwide
GT. Inc.

Hagle Mfg. Co.
Hanson Silo Company
Harlo Products Corporation
Hawkeye Steel Products Inc.
HCC, Inc.
Hesston Corporation
Hiab Cranes & Loaders, Inc.
Hi-Ranger, Inc.
Holan Manufacturing Inc.
H.D. Hudson Manufacturing Co.
Hutchinson Will-Rich Mfg. Co.
Hydracrane Inc.

ICM Industries, Inc.
Indag Industries Inc.
Ingersoll Rand Road
  Machinery Division
Intergy Inc.
Iowa Mold Tooling Co.

JCB, Inc.
JLG Industries Inc.
J-Star Industries Inc.

EMI Active Members (continued)

K.D. Manliou, Inc.
KMN Modern Farm Equipment, Inc.
Kobalco America Inc.
Krause Plow Corporation Inc.
Kubota Tractor Corporation

Leon-Ram Enterprises, Inc.
Lift-A-Loft Corporation
Livestock Monitoring Systems, Inc.
Load Lifter Mfg. Ltd.
J.E. Love Company
Lowe Manufacturing Co., Inc.
Lull Corporation

MacDon Industries Ltd.
Major Equipment Co., Inc.
Manitex, Inc.
Mark Industries Inc.
Massey-Ferguson Inc.
Master Craft Industrial Equip. Corp.
Mathews Company
Mayrath Industries Inc.
Mayville Engineering Co. Inc.
McConnell Tractors Ltd.
Ralph McKay (Canada) Ltd.
McLaughlin Mfg. Co.
McMillen Div. of States Eng. Corp.
Meadows Products of Michigan
Melred Borzall Inc.
Melroe Company
MF Industrial
mfe/York Division
Miller St Nazianz Inc.
Mitsubishi Heavy Industries Ltd.
Mustang Mfg. Co., Inc.

National Crane Corporation

Palm Industries Inc.
Patz Sales Inc.
Pertach, Inc.
Pettibone Michigan
Pierce-Correll Corporation
Pitman Mfg. Company Inc.
Pixall Corporation

Powell Mfg. Co., Inc.
Prime Motor Company

Reach-All, Inc.
Reedril, Inc.
Reese Engineering Sales Ltd.
Rohn Agri Products
Rome Industries, Inc.

Sanderson Equipment Inc.
Sellick Equipment Ltd.
Simon Aerials Inc.
Simon-RO Corporation
Simon-Telelect Inc.
Simpson Machine Corp.
Sims Mfg Company
Skyjack Inc.
A.O. Smith Harvestore Products
Snorkel Economy, A Figgie
  International Company
Strato-Lift Inc.
Sweepster, Inc.

Taylor Pittsburgh Implement Div.
Teco Inc.
Terramite Construction Equip. Co.
Thomas Equipment Ltd.
Timberjack, Inc.
Time Manufacturing Co.
Toyota Industrial Equipment
TRAK International Inc.
The Tye Company

Underground Technology, Inc.
Universal Dairy Equipment Inc.
Up-Right Inc.

Valmet Gafner, Inc.
Vermeer Manufacturing Co.
Vibra King, Inc.

Wain-Roy Inc.
Western Combine Corporation
Westfalia Systemat
Westfield Industries Ltd.

EMI Active Members (continued)

Westmoor Ltd. Dairy Division
White-New Idea Farm Equipment Co.
Wil-Rich
Workforce Products, Inc.

Yanmar Tractor (USA) Inc.

Zetor Tractors, American

Associate Membership

ABC Publishing Ag Group
Ace Pump Corporation
Acme Steel Company
Aeroquip Corporation
Aetna Bearing co
Allied Signal Inc.
Armco Steel Company
Armstrong Rim & Wheel Manufacturing Co.
Associated Construction Publications
Atwood Mobile Products

B & B Industries
Barrel Service Company
Bethlehem Steel Corporation
Bondioli & Paveal, Inc
Robert Bosch Corporation
Bridgestone/Firestone Inc.
Burgess-Norton Mfg. Co.
Busatis Bros. Mfg., Inc.

California Farm Equipment Show
Calumet Steel Co.
Carlson Marketing Group
CCU, Inc.
Central Steel & Wire Co.
Chicago Tube & Iron Co.
Citicorp (USA) Inc.
Citicorp Dealer Finance
Clark Components International
CMF & Z
Control Concepts Inc.
CR Industries
Cummins Engine Co.
Curtis Machine Company, Inc.

Dana Corporation
Dana Corporation-Drive Train Service Corporation
Dana Corporation-Fluid Product Sales Division
Dana Corporation-Mobile Fluid Products Division
Dana Corporation-Perfect Circle Products Division
Dana Corporation-Spicer Off-Highway Axle Division
Dana Corporation-Spicer Universal Joint Division
Dana Corporation-Warner Electric Division
Dataquest Inc.
Dayco Products, Inc.
Dealer Parts Network
Detroit Diesel Corporation
Dico, Inc
Diesel & Gas Turbine Publications
Doerfer Engineering
Donaldson Company, Inc.
Drives Incorporated

Eagle Engineering & Manf. Inc.
Eaton Corporation
Electric Power & Farm Equip. Show
Engineered Products Co.
Equipment Management Magazine

Fairfield Mfg. Co.
Farm Journal Inc.
Farm Press Publications
Farm Science Review
Federal-Mogul Corporation

EMI Associate Membership (continued)

Feralloy Corporation
First National Bank of Chicago
Fleetguard, Inc
Forward Mfg. Company
Fuji Tekko Co. Ltd.

Gales Rubber Company
Gear Products Inc.
Goodyear Tire & Rubber
Grammer Inc.
Grinnell Mutual Reinsurance Co.

H & L Tooth Company
HBJ Farm Publications
Heartland Communications Group, Inc.
Herschel Corporation
Hurth Aide North America Inc.
Husco International Inc.
Hydro-Lina Mfg. Co.

Independence Tube Corporation
Indiana Mills & Manufacturing Inc.
Ingersoll Products Co.
Inland Steel Company
International Transmissions Ltd.
ITT Commercial Finance

JETRO Chicago
Johnson Hill Press, Inc.

Kenhar Products, Inc.
Knapheide Mfg. Co.
Kondex Corporation

Loegering Mfg., Inc.
Lombardini, U.S.A., Inc.
Long Mfg. Ltd.
LTV Steel Company
Lund International

MacKay & Company
Magna-Power Inc.
Marmom-Herrington All-Wheel Drive
MCI Planners Inc.
McCord Heat Transfer Corp.
W. McDougall & Associates
Metron Steel Corporation
Mid-West Company
Milsco Mfg. Co.
Milwaukee Forge
Modine Mfg. Co.
Moline Paint Mfg. Co.
Morse Controls Division

Neapco Inc.
Nelsen Steel Company
Nelson DoCamp Corp.
Nelson Industries Inc.
Nippondenso Sales, Inc.
North American Equipment Dealers Association
North American Farm Show Council
NPS Metal Service Div. of National Materials Limited Partnership
NTN Bearing Corporation of America

OEM Controls, Inc.
Oldenburg Group Inc.
Onan Corporation, Engine Division

Parker Hannifin Corporation
Phoenix International Corporation
Pirelli Steel Corporation
Pirglas/Armstrong Tire Corporation
Power Show Ohio
Powerline, Inc.
PPG Industries, Inc.
Progressive Farmer

Quality Screw Products, Inc.

Racine Fluid Power, Inc.
Racor Division of Parker Hannifin Corporation
Raybestos Products Co
Road & Bridges Magazine
Robinson Steel Co.
Rockford Powertrain Inc.
Rockwell International
Joseph T. Ryerson & Son Inc.

EMI Associate Membership (continued)

Sajac Company Inc.
Sauer-Sundstrand Company
Sears Mfg. Co.
SGM Company Inc.
Snap-Tite Inc.
Stanadyne Automotive Corp.
Stanley Hydraulic Tools
Stewart Warner Hobbs Corporation
Stewart Warner South Wind Corp.
Successful Farming
Carl Sulberg Gmbrl & Co.
Sunbelt Agricultural Exposition Inc.
Synchro-Start Products Inc.

Teledyne Portland Forge
Teledyne Total Power
Timken Company
Titan Wheel International Inc.
Torrington Company
Tramac Corporation
TRW Automotive Sector
TRW Ross Gear Division
TRW Transmission Electronics Division
TRW Valve Division
Twin Disc, Inc.

UNFI-Leavitt
U.S. Axle, Inc.

Valmont Industries, Inc.
Valspar Corporation
Vickers, Incorporated
V/R Tubular Products

Walterscheid, Inc
Weasler Engineering Inc.
Webster Electric Company Inc.
Western Association
Wilton Corporation

Young Radiator Company

Zahnradfabrik Passau GmbH
ZF of North America
Ziagebein Associates, Inc.

Construction Industry Manufacturers Association

The Construction Industry Manufacturers Association (CIMA) is an 80-year-old international trade association representing over 175 manufacturers of construction machines, components and attachments used around the world. The equipment is used primarily in the heavy construction, earthmoving, roadbuilding, housing, mining, material handling, maintenance, energy and forestry fields.

Members

The Aberdeen Group
Aeroquip Corporation
AGL Corporation
Ajusta-Buckets, Inc.
Akkerman Mfg. Co., Inc.
Allen Engineering Corp.
Allied Steel & Tractor Prdts.
Allmand Bros., Inc.
American Test Center
Amida Industries Inc.

CIMA Members (continued)

Amoco Torlon Products, Inc.
Analysts Inc.
Associates Commercial Corp.
Associated Construction Pblcns.
Astec Industries, Inc.
Atlas Copco AB/Atlas Copco

Barber-Greene Company Equipment
Baum Publications Limited
Better Roads
Beuthling Manufacturing Co.
Blaw-Knox Construction Eqp Corp.
BNR Equipment Ltd.
BOMAG (USA)
Bondioli & Pavesi Inc.
Briggs & Stratton Corp/Ind'l Div

Cahners Publishing Company
Canica Export Corporation
Cedarapids Inc.
Century II Inc.
Champion Road Machinery Limited Hunter
Chemgrout Inc.
CH & E Mfg. Company, Inc.
The CIT Group/Ind'l Financing
Clark-Hurth Components
CLS Laser Systems, Inc.
Coleman Engineering Inc.
Concrete Equipment Company Inc.
Construction Electronics Co., Inc
Construction Equip Ins Agency/KMC
Construction News Publishing Net
Cornell Crane Mfg. Ltd.
Corroon & Black of Wisconsin, Inc
Cummins Engine Company, Inc.
Cushion Cut, Inc.

Daewoo Machinery/Daewoo Heavy Ind
Daily Commercial News/Southam
Dataquest Inc., Machinery Inform
David White Inc.
Dealer Parts Network, Inc.
Denman Tire Corporation
Detroit Diesel Corp.
Deutz Corp.
Dico Tire, Inc.
Drilling Technique Co.
Eagle Crusher Company, Inc.
Eagle Engineering & Mfg., Inc
Eagle Iron Works
ECCO-Electronic Controls Company
ECHO, Incorporated
Edgell Communications
Efficiency Production Inc.
Engineering News-Record
Equipment Data Associates, Inc.
Equipment Management Magazine
Equipment Today
Erie Strayer Co.
ESCO Corporation
Etnyre International

Fabco Power Inc.
Fiatallis North America, Inc.
Finalay Hydrascreen OMAG/Finlay

Gardner-Denver & Mining
GDM, Incorporated
Gehl Company
Gencor Industries Inc.
General Engines Co. Inc.
GH-Hensley Industries, Inc.
GOMACO Corporation
Gorman-Rupp Company (The)
Grandall Company The
Grasan Equipment Co., Inc.
Griswold Machinery & Engineering
Grove Worldwide

Hayes Industrial Brake Inc.
Heavy Constrn News/Maclean
Heltzel Company
Hendrix Mfg. Co., Inc.
Hercules Engine, Inc.
Hobart Brothers Company
Huber Reversible Fan Inc.
HYPAC (Formerly Hyster Co.)
Hyundai Constr. Equip.

CIMA Members (continued)

Ingersoll-Rand Company
Ingram Mfg. Co.
Intercontinental Pub. Inc.
Iowa Mold Tooling Co., Inc.

JLG Industries Inc.
Jordan-Sitter Associates

Kato Works Co. Ltd.
Kenworth Truck Company
Kerins Industries, Inc.
Kohler Company
Komatsu Dresser Company
Kordy-Colyer
Krupp Industries Inc.

LaBounty Mfg. Inc.
Laser Alignment Inc.
L.B. Foster company
LINCOLN a Pentair Company
Lindsay Manufacturing
Link-Belt Construction Equip. Co.
L & M Radiator

Mack Truck, Inc.
Maclean Hunter Publishing Company
Magnum Diamond & Machinery, Inc.
Manitowoc Engineering Co. (HOLD BOARD)
Marathon LeTourneau, Longview Div
Markload Systems, Inc.
M-B-W, Incorporated
McLellan Equipment, Inc.
Metal Forms Corporation
MICO Incorporated
Milltronics, Ltd.
Minnich Mfg. Co., Inc.
MKT Manufacturing Inc.
My Little Salesman

Navistar Int'l Transportation
Neal Manufacturing Company Inc.
Nordberg Inc.

O & K Trojan, Inc.
Ozzie's Pipeline

Parker Hannifin Corp.
PAT Equipment Corp., Inc.
Payhauler Corp.
Phillips Temro
Pileco, Inc.
Portec Inc.
Power Curbers, Inc.
Powerscreen of America, Inc.
Precision Hydrostatics, Inc.
Prince Manufacturing Corp.
Production Engineered Products
Public Works Publications

Remsey Technology Inc.
Rammer U.S.A. Inc.
Ranco Trailers
Randall Publishing/Equip World
The Read Corporation
Recycling Systems Inc.
Rexworks Inc.
RGC Construction Equipment

Ritchie Bros. Auctioneers
Roads & Bridges Magazine
Rock & Dirt Magazine
Rockland Manufacturing Co.
Rockwell International
Rosco Manufacturing Company
Ross Company

Samsung Shipbuilding & Heavy Ind.
Sauer-Sundstrand
Scan Road Inc./Nobel Industries
Schaeff Inc.
Shuttlelift Inc.
Sioux Steam Cleaner Corporation
Snap-Tite, Inc.
Snorkle-Economy
Spectra-Physics Laserplane, Inc.

CIMA Members (continued)

Speed Shore Corporation
Stanley Hydraulics Tools
Stephens Mfg. Co., Inc.
Stone Construction Equipment
Sullivan Industries, Inc.

Tadano Ltd.
Tamrock Corp/Driltech, Inc.
Target Products, Inc.
Taylor Machine Works, Inc.
TC Industries/Processed Steel
Teledyne CM Products, Inc.
Teledyne Total Power
TEREX Corp/TEREX Div/Koehring Crane
Excavators/NW Engineering Unit Rig
Thompson Pump & Mfg. Company
Trail King Industries, Inc.
Tramc Corporation
Transwind, Div. Water Bonnet Mfg.

Vickers, Incorporated
VME Americas, Inc.

Werk-Brau Company Incorporated
Wirtgen America, Inc.
Wisconsin Electrical Mfg. Co., Inc.
Wyco Tool Company (The)

National Marine Manufacturers Association

The National Marine Manufacturers Association (NMMA) represents manufacturers of boats, marine engines, accessories and services. Marine engine manufacturers are represented by the Association of Marine Engine Manufacturers (AMEM), whose members are listed below.

Members

American Eagle Marine, Inc.
American Honda Motor Co.
American Suzuki Motor Corp.
Baker Inc.
Caterpillar Inc.
Commander Marine Corp.
Crusader Engines
Cummins Engine Co, Inc.
Detroit Diesel Corp.
Eagle Engine Marine
Flagship Marine Engine Co., Inc.
Gil Marine
Indmar Products Co., Inc.
Isuzu Diesel of North America
IVECO AIFO S.P.A
Johnson & Towers, Inc.
Lister-Petter, Inc.
Marine Power, Inc.
Mariner Outboards
Mercruiser
Mercury Marine
Merlin Marine Engine Group
MTU of North America, Inc.
Nissan Marine & Power Products
Outboard Marine Corporation
Paxman Diesels
Peninsular Diesel, Inc.
Pleasurecraft Marine Engines

NMMA Members (continued)

Stewart & Stevenson Services
U.S. Marine Power
Universal Motors-Medalist
Volvo Penta of America
Westerbeke Corporation
Yamaha Motor Corp.

International Snowmobile Industry Association

The International Snowmobile Industry Association (ISIA) is the trade association for the snowmobile industry.

Regular Members

Arctco, Inc.
Bombardier, Inc.
Yamaha Motor Company, Ltd.

Associate Members

Arctic Recreational Distributors, Inc.
ASV Incorporated
Brooks Equipment (West) Ltd.
Camoplast Inc.
Charles R. Bell, Ltd.
Eastern Marketing Ltd.
Gilles Soucy, Inc.
Groupe P.P.D. Inc.
Hi-Lex Corporation
IBC Canada
Kanematsu-Gosho (USA) Inc.
Marr's Leisure Products Inc.
Mikuni American Corporation
NGK Spark Plugs Canada Ltd.
Nielsen Distributing International
Northern Stores Inc.
Saint Paul Metalcraft, Inc.
Suzuki Motor Corporation
Sveriges Snofordonleverantorer
The Bryant Corporation
Wrico Stamping Company of Minnesota

Appendix F. Technical Review Group Representatives

The following groups and organizations external to EPA provided a technical reviewer to serve on a technical review panel. This panel provided feedback to staff on technical issues during the study.

California Air Resources Board (CARB)
Construction Industry Manufacturers Association (CIMA)
Engine Manufacturers Association (EMA)
Equipment Manufacturers Institute (EMI)
Industrial Truck Association (ITA)
National Marine Manufacturers Association (NMMA)
Northeast States for Coordinated Air Use Management (NESCAUM)
Outdoor Power Equipment Institute, Inc. (OPEI)
Portable Power Equipment Manufacturers Association (PPEMA)

Appendix G. Emission Inventories Developed Using SIP and CARB Data

As EPA began its study of nonroad emissions, one of the most comprehensive sources of data already available were emission inventories developed for State Implementation Plans (SIPs). EPA considered existing draft emission inventories developed by states in 1987 SIPs and recent inventories developed by the California Air Resources Board (CARB) for their SIPs. SIPs from eighteen geographical areas were used, as were CARB analyses for seven air basins in California. Table G-01 provides a list of these areas.

Table G-01. SIP and CARB Inventories Considered.

SIP Geographical Area	CARB Air Basin
Atlanta, GA MSA	Mountain Counties
Beaumont-Port Arthur, TX MSA	Sacramento Valley
Boston-Lawrence-Salem-Lowell-Brockton, MA NECMA	San Diego
Chicago-Gary-Lake County IL-IN-WI CMSA (IL portion)	San Francisco Bay Area
State of Connecticut	San Joaquin Valley
Dallas-Fort Worth, TX CMSA	South Central Coast
Denver-Boulder CO CMSA	South Coast
Duluth, MN-WI MSA (MN portion)	
El Paso, TX MSA	
Fort Collins-Loveland, CO MSA	
Hartford-New Britain-Middletown-Bristol, CT NECMA	
Houston-Galveston-Brazoria TX CMSA	
Louisville, KY CMSA (KY portion)	
Minneapolis-St. Paul MN-WI MSA (MN portion)	
State of New Jersey	
State of Massachusetts	
Seattle-Tacoma WA CMSA	
Springfield, MA NECMA	

Certain gaps and inconsistencies, as well as outdated emission factors, in the SIP inventories made it difficult to use inventories as available. However, the SIP inventories considered were developed in enough detail that it was possible to discern how activity levels for nonroad mobile sources were estimated. EPA resolved the inconsistencies where possible and substituted new emission factors in order to generate new inventories based on the SIP data. The emission inventories developed by CARB for nonroad mobile sources were much more detailed than those from the SIPs, and were summarized without revision by EPA.

EPA also contracted for the gathering and compiling of new, comprehensive emission inventories in 24 cities, as described in the body of this report. The SIP inventories categorized nonroad mobile sources in slightly different ways than EPA did in developing new emission inventories. In Table G-02, the SIP and CARB categories are compared with the ten equipment categories developed by EPA for this study.

Table G-02. Different Ways of Categorizing Nonroad Mobile Sources.

SIPs	CARB	New EPA 24-City
Construction Equipment	Heavy-Duty Farm Equipment	Agricultural Equipment
Industrial Equipment	Heavy-Duty Construction Equip.	Logging Equipment
Lawn & Garden Equip.	Utility, Lawn, Garden Equip.	Construction Equipment
Off-Highway Motorcycles	Off-Highway Mobile Equipment	Light Commercial
Snowmobiles	Marine Vessels	Industrial Equipment
Recreational Boats		Airport Service Equipment
Commercial Marine Vessels		Lawn & Garden Equipment
		Recreational Equipment Recreational Marine
		Commercial Marine Vessels

The following section describes in greater detail the data obtained from SIPs and the methodology used in creating the inventories using this data.

SIP-Based Activity Levels

Emission inventories are developed as part of State Implementation Plans, or SIPs, which are submitted periodically to EPA by areas that do not comply with NAAQS. SIPs themselves outline means by which state authorities plan to meet the NAAQS. Generally, this includes a plan for emission reductions, which are projected based on the baseline emission inventory. State air quality planners generally develop emission inventories for nonattainment areas following the methodologies outlined in the existing EPA guidance.[1]

EPA provides information on preparing emission inventories for SIPs in a series of five documents entitled *Procedures for Emission Inventory Preparation* (henceforth simply *Procedures*). The first volume gives an overview of the methodologies and reporting requirements for emission inventories and subsequent volumes give the methodologies whereby activity levels may be estimated at the county level for point sources,[2] nonroad and highway mobile sources,[3] and other area sources.[4] Although all mobile sources are a subcategory of area sources, the term "mobile source" was often used in past SIP emission inventories to refer solely to highway vehicles Emissions from all other mobile sources are, in such cases, often reported as "off-highway mobile sources" in the area source inventory. This is likely due to the fact that highway vehicles are already regulated and therefore much better characterized than nonroad mobile sources. Also, nonroad mobile source activity is often more similar to that of other area sources than is highway vehicle activity. For example, construction equipment activity can be characterized by considering the construction industry employment during the inventory period. Similarly, fuel consumption (e.g. heating oil) in commercial and industrial applications may be estimated using employment statistics in the applicable industries. Where possible, the emission factors in the EPA guidance document were updated to include more recent data. A full discussion of the development of revised SIP emission factors is contained in Appendix I.

After activity levels for the various source types have been estimated, emission factors[*] must be applied to calculate emissions in mass per unit time for each of the pollutants being studied in the inventory area.

Inventories developed for SIPs are usually developed for a given base year (BY); hence emissions are expressed in tons per year (tpy). In areas where nonattainment is a seasonal problem, the inventories may also be temporally adjusted. In many areas, ozone nonattainment is predominately a summertime problem; therefore, emissions of ozone precursors are expressed in tons per summer day (tpsd). Similarly, because CO nonattainment is usually a wintertime problem,[†] CO emissions are often expressed in tons per winter day (tpwd). In its analysis of SIP emission inventories, EPA used those seasonal adjustments that were reported in the SIPs.

For this study, EPA has examined several of the draft SIP inventories developed by states for the 1987 and 1988 BY. Because of the CAAA requirement that states develop emission inventories for the 1990 BY, many of the 1987/1988 draft inventories have not been finalized at this time. However, because the 1990 BY inventories will not be completed in 1991, only the earlier inventories may be considered for this study, despite the fact that they are still in draft form.

In analyzing 1987 base year emission inventories from SIPs, EPA extracted the activity levels calculated for nonroad engines and vehicles. Because the activity levels were separated from the emission factors, it was possible to apply the emission factors developed as part of this study to the activity levels to develop revised emission inventories that have benefitted from improvements to the emission factors.

In adjusting the SIP emission inventories for seasonal activity variations, EPA determined what assumptions had been used in the original inventory and applied only those having to do with seasonal variations. Consequently, these seasonal temporal adjustments are different from those made in inventories that also considered day-to-day activity fluctuations or daily temporal adjustments.

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[*] Emission factors for nonroad mobile sources that are currently available from EPA guidance are given in *Compilation of Air Pollutant Emission Factors, Volume II: Mobile Sources*, Fourth Edition and Supplements, AP-42, U.S. Environmental Protection Agency, Research Triangle, Park, NC, September 1985.

[†] There are notable exceptions, however. The following areas had two or more summertime CO exceedances between 1986 and 1988: Cleveland, Ohio; New York City, New York; St. Louis, Missouri; and Steubenville, Ohio.

Summaries of the analysis of SIP emission inventories are given in the following tables. Detailed results of the SIP emission inventories are given in *State Estimates of Nonroad Engine and Vehicle Emissions*,[5] which documents for each nonattainment area studied the nonroad engine and vehicle activity levels derived, the emissions calculated, and the emissions from other sources (i.e., highway vehicles, other area and point sources).

Emission inventories prepared by the CARB are considered separately because inventories for some nonroad mobile source categories have recently been developed by CARB in support of California's proposed regulations applicable to such sources. These emission inventories are generally more refined than those that have been developed by states following the existing EPA guidance. Furthermore, they use different nonroad mobile source categories and are, therefore, not directly comparable to the draft SIP inventories.

Because of these differences from the SIP-based inventories, data from California's nonroad mobile source emission inventories were used as provided and compared to the highway and other source emissions given in the March 1990 version of the 1987 emission inventory prepared by CARB. The nonroad mobile source categories for which CARB has recently developed emission inventories are: utility and lawn and garden equipment,[6] heavy-duty farm and construction equipment,[7] and commercial marine vessels.[8] [‡] These inventories are also summarized in the following tables.

[‡] Study continues for other categories. These reports were available for use in this study.

EMISSION INVENTORY SUMMARY

Geographical Area: Denver
Base Year: 1987
Last Change to Activity Levels: 07/03/91
Last Emission Factor Changes: 07/05/91

Table G-03

Category	CO tpy	Winter CO tpwd	Winter % Total CO tpwd
Farm Equipment	0	0.00	0.00%
Construction Equipment	7,473	8.21	0.50%
Industrial Equipment	17,478	48.02	2.94%
Lawn & Garden Equipment	0	0.00	0.00%
Off Highway Motorcycles	0	0.00	0.00%
Snowmobiles	0	0.00	0.00%
Recreational Boats	0	0.00	0.00%
Marine Vessels	0	0.00	0.00%
Nonroad Engines and Vehicles	24,951	56.23	3.44%
Highway Mobile Sources		1,416.60	86.70%
Other Area and Point Sources		161.18	9.86%
All Area and Point Sources		1,634.00	100.00%

EMISSION INVENTORY SUMMARY

Geographical Area: Ft. Collins/Greeley/Loveland
Base Year: 1987
Last Change to Activity Levels: 07/03/91
Last Emission Factor Changes: 07/05/91

Table G-04

Category	CO tpy	Winter CO tpwd	Winter % Total CO tpwd
Farm Equipment	0	0.00	0.00%
Construction Equipment	1,307	1.44	0.61%
Industrial Equipment	2,594	7.13	3.01%
Lawn & Garden Equipment	0	0.00	0.00%
Off Highway Motorcycles	0	0.00	0.00%
Snowmobiles	0	0.00	0.00%
Recreational Boats	0	0.00	0.00%
Marine Vessels	0	0.00	0.00%
Nonroad Engines and Vehicles	3,901	8.56	3.62%
Highway Mobile Sources		198.21	83.76%
Other Area and Point Sources		29.87	12.62%
All Area and Point Sources		236.65	100.00%

EMISSION IN. .TORY SUMMARY

Geographical Area: Connecticut
Base Year: 1987
Last Change to Activity Levels: 07/03/91
Last Emission Factor Changes: 07/05/91

Table G-05

				Summer		Summer		Winter	
Category	HC tpy	NOx tpy	CO tpy	HC tpsd	NOx tpsd	% Total HC tpsd	% Total NOx tpsd	CO tpwd	% Total CO tpwd
Farm Equipment	602	728	9,022	2.48	3.00	0.31%	0.77%	0.00	0.00%
Construction Equipment	2,382	15,012	29,414	9.80	61.78	1.22%	15.81%	0.00	0.00%
Industrial Equipment	2,029	3,906	35,591	5.57	10.73	0.69%	2.75%	97.78	4.05%
Lawn & Garden Equipment	2,192	107	21,594	9.02	0.44	1.12%	0.11%	0.00	0.00%
Off Highway Motorcycles	577	12	1,525	6.34	0.13	0.79%	0.03%	0.00	0.00%
Snowmobiles	113	2	166	0.00	0.00	0.00%	0.00%	2.18	0.09%
Recreational Boats	6,060	410	13,051	50.09	3.39	6.23%	0.87%	0.00	0.00%
Marine Vessels	17	386	43	0.05	1.07	0.01%	0.27%	0.12	0.00%
Nonroad Engines and Vehicles	13,971	20,582	110,406	83.35	80.53	10.37%	20.61%	100.08	4.15%
Highway Mobile Sources				472.44	207.73	58.79%	53.16%	1,625.32	67.36%
Other Area and Point Sources				247.76	102.52	30.83%	26.23%	687.39	28.49%
All Area and Point Sources				803.55	390.78	100.00%	100.00%	2,412.79	100.00%

EMISSION IN. .TORY SUMMARY

Geographical Area: Connecticut-Hartford NECMA
Base Year: 1987
Last Change to Activity Levels: 07/03/91
Last Emission Factor Changes: 07/05/91

Table G-06

				Summer		Summer		Winter	
Category	HC tpy	NOx tpy	CO tpy	HC tpsd	NOx tpsd	% Total HC tpsd	% Total NOx tpsd	CO tpwd	% Total CO tpwd
Farm Equipment	218	266	3,295	0.90	1.09	0.34%	0.88%	0.00	0.00%
Construction Equipment	964	6,079	11,928	3.97	25.02	1.50%	20.18%	0.00	0.00%
Industrial Equipment	713	1,372	12,502	1.96	3.77	0.74%	3.04%	34.35	3.97%
Lawn & Garden Equipment	804	39	7,924	3.31	0.16	1.25%	0.13%	0.00	0.00%
Off Highway Motorcycles	204	4	539	2.24	0.05	0.85%	0.04%	0.00	0.00%
Snowmobiles	54	1	80	0.00	0.00	0.00%	0.00%	1.05	0.12%
Recreational Boats	542	18	1,098	4.48	0.15	1.70%	0.12%	0.00	0.00%
Marine Vessels	11	260	29	0.03	0.71	0.01%	0.58%	0.08	0.01%
Nonroad Engines and Vehicles	3,511	8,039	37,394	16.89	30.95	6.39%	24.96%	35.47	4.10%
Highway Mobile Sources				170.45	74.94	64.52%	60.45%	593.59	68.67%
Other Area and Point Sources				76.85	18.08	29.09%	14.58%	235.38	27.23%
All Area and Point Sources				264.18	123.97	100.00%	100.00%	864.44	100.00%

EMISSION INVENTORY SUMMARY

Geographical Area: Alanta
Base Year: 1987
Last Change to Activity Levels: 06/04/91
Last Emission Factor Changes: 07/05/91

Table G-07.

					Summer		Summer	
Category	HC tpy	NOx tpy	% Total HC tpy	% Total NOx tpy	HC tpsd	NOx tpsd	% Total HC tpsd	% Total NOx tpsd
Farm Equipment	431	919	0.22%	0.53%	2.66	5.67	0.42%	1.12%
Construction Equipment	1,410	8,383	0.72%	4.83%	4.65	27.67	0.74%	5.48%
Industrial Equipment	1,239	2,387	0.63%	1.38%	3.40	6.56	0.54%	1.30%
Lawn & Garden Equipment	1,493	52	0.76%	0.03%	8.20	0.29	1.30%	0.06%
Off Highway Motorcycles	331	7	0.17%	0.00%	1.00	0.02	0.16%	0.00%
Snowmobiles	0	0	0.00%	0.00%	0.00	0.00	0.00%	0.00%
Recreational Boats	1,030	42	0.52%	0.02%	8.51	0.35	1.35%	0.07%
Marine Vessels	0	0	0.00%	0.00%	0.00	0.00	0.00%	0.00%
Nonroad Engines and Vehicles	5,934	11,791	3.02%	6.80%	28.43	40.56	4.52%	8.03%
Highway Mobile Sources	125,362	69,146	63.88%	39.86%	391.60	216.08	62.19%	42.80%
Other Area and Point Sources	64,954	92,553	33.10%	53.35%	209.64	248.24	33.29%	49.17%
All Area and Point Sources	196,250	173,490	100.00%	100.00%	629.67	504.88	100.00%	100.00%

EMISSION INVENTORY SUMMARY

Geographical Area: CHICAGO CMSA: ILLINOIS PORTION
Base Year: 1988
Last Change to Activity Levels: 07/03/91
Last Emission Factor Changes: 07/05/91

Table G-08.

			Summer		Summer	
Category	HC tpy	NOx tpy	HC tpsd	NOx tpsd	% Total HC tpsd	% Total NOx tpsd
Farm Equipment	322	787	1.06	2.60	0.05%	0.25%
Construction Equipment	855	6,116	2.82	20.18	0.13%	1.95%
Industrial Equipment	3,883	7,476	12.81	24.67	0.60%	2.39%
Lawn & Garden Equipment	3,610	127	13.22	0.46	0.62%	0.04%
Off Highway Motorcycles	1,017	21	5.59	0.11	0.26%	0.01%
Snowmobiles	0	0	0.00	0.00	0.00%	0.00%
Recreational Boats	8,421	534	64.78	4.11	3.02%	0.40%
Marine Vessels	420	9,635	1.16	26.47	0.05%	2.56%
Nonroad Engines and Vehicles	18,528	24,696	101.45	78.61	4.73%	7.60%
Highway Mobile Sources			991.88	352.14	46.23%	34.06%
Other Area and Point Sources			1,052.19	603.01	49.04%	58.33%
All Area and Point Sources			2,145.52	1,033.76	100.00%	100.00%

EMISSION INVENTORY SUMMARY

Geographical Area: Louisville, KY
Base Year: 1988
Last Change to Activity Levels: 05/09/91
Last Emission Factor Changes: 07/05/91

Table G-09.

			Summer		Summer	
Category	HC tpy	NOx tpy	HC tpsd	NOx tpsd	% Total HC tpsd	% Total NOx tpsd
Farm Equipment	421	1,369	1.27	4.14	2.69%	14.75%
Construction Equipment	286	1,798	0.92	5.76	1.94%	20.55%
Industrial Equipment	369	710	1.18	2.28	2.50%	8.11%
Lawn & Garden Equipment	414	15	1.47	0.05	3.12%	0.18%
Off Highway Motorcycles	56	1	0.20	0.00	0.43%	0.01%
Snowmobiles	0	0	0.00	0.00	0.00%	0.00%
Recreational Boats	225	7	0.80	0.02	1.69%	0.09%
Marine Vessels	0	0	0.00	0.00	0.00%	0.00%
Nonroad Engines and Vehicles	1,771	3,900	5.84	12.28	12.36%	43.71%
Highway Mobile Sources			19.89	8.99	42.08%	32.06%
Other Area and Point Sources			21.54	6.80	45.56%	24.23%

EMISSION INVENTORY SUMMARY

Geographical Area: Massachusetts
Base Year: 1987
Last Change to Activity Levels: 07/03/91
Last Emission Factor Changes: 07/05/91

Table G-10.

				Summer		Summer		Winter	
Category	HC tpy	NOx tpy	CO tpy	HC tpsd	NOx tpsd	% Total HC tpsd	% Total NOx tpsd	CO tpwd	% Total CO tpwd
Farm Equipment	827	1,758	11,033	3.50	7.45	0.28%	0.96%	7.28	0.21%
Construction Equipment	1,791	11,239	22,173	4.92	30.88	0.39%	3.98%	60.92	1.72%
Industrial Equipment	3,059	5,889	53,659	8.40	16.18	0.66%	2.08%	147.41	4.17%
Lawn & Garden Equipment	2,335	82	17,969	8.34	0.29	0.66%	0.04%	0.00	0.00%
Off Highway Motorcycles	375	8	990	1.34	0.03	0.11%	0.00%	0.00	0.00%
Snowmobiles	535	8	789	0.00	0.00	0.00%	0.00%	5.19	0.15%
Recreational Boats	13,717	680	28,622	75.37	3.74	5.95%	0.48%	0.00	0.00%
Marine Vessels	132	2,971	309	0.37	6.66	0.03%	0.86%	0.99	0.03%
Nonroad Engines and Vehicles	22,771	22,634	135,544	102.25	65.22	8.07%	8.40%	221.79	6.27%
Highway Mobile Sources				670.22	335.35	52.88%	43.22%	2,372.62	67.05%
Other Area and Point Sources				494.90	375.43	39.05%	48.38%	944.14	26.68%
All Area and Point Sources				1,267.37	776.00	100.00%	100.00%	3,538.55	100.00%

EMISSION INVENTORY SUMMARY

Geographical Area: Boston NECMA
Base Year: 1987
Last Change to Activity Levels: 07/03/91
Last Emission Factor Changes: 07/05/91

Table G-11.

				Summer		Summer		Winter	
Category	HC tpy	NOx tpy	CO tpy	HC tpsd	NOx tpsd	% Total HC tpsd	% Total NOx tpsd	CO towd	% Total CO towd
Farm Equipment	213	452	2,835	0.90	1.91	0.12%	0.46%	1.87	0.08%
Construction Equipment	1,375	9,782	16,097	3.78	26.87	0.49%	6.49%	44.22	2.00%
Industrial Equipment	1,730	1,151	33,408	4.75	3.16	0.62%	0.76%	91.78	4.15%
Lawn & Garden Equipment	1,331	47	10,241	4.75	0.17	0.62%	0.04%	0.00	0.00%
Off Highway Motorcycles	237	5	627	0.85	0.02	0.11%	0.00%	0.00	0.00%
Snowmobiles	339	5	500	0.00	0.00	0.00%	0.00%	3.29	0.15%
Recreational Boats	6,393	317	13,339	35.12	1.74	4.56%	0.42%	0.00	0.00%
Marine Vessels	91	1,777	221	0.25	4.96	0.03%	1.20%	0.61	0.03%
Nonroad Engines and Vehicles	11,708	13,535	77,268	50.41	38.83	6.55%	9.37%	141.77	6.41%
Highway Mobile Sources				414.98	206.93	53.90%	49.94%	1,470.29	66.51%
Other Area and Point Sources				304.49	168.62	39.55%	40.69%	598.54	27.08%
All Area and Point Sources				769.88	414.38	100.00%	100.00%	2,210.61	100.00%

EMISSION INVENTORY SUMMARY

Geographical Area: Springfield NECMA
Base Year: 1987
Last Change to Activity Levels: 07/03/91
Last Emission Factor Changes: 07/05/91

Table G-12.

			Summer		Summer	
Category	HC tpy	NOx tpy	HC tpsd	NOx tpsd	% Total HC tpsd	% Total NOx tpsd
Farm Equipment	148	315	0.63	1.33	0.49%	2.01%
Construction Equipment	147	922	0.40	2.53	0.32%	3.81%
Industrial Equipment	306	580	0.84	1.62	0.66%	2.44%
Lawn & Garden Equipment	240	8	0.86	0.03	0.68%	0.05%
Off Highway Motorcycles	37	1	0.13	0.00	0.11%	0.00%
Snowmobiles	54	1	0.00	0.00	0.00%	0.00%
Recreational Boats	2,198	109	12.08	0.60	9.50%	0.90%
Marine Vessels	0	0	0.00	0.00	0.00%	0.00%
Nonroad Engines and Vehicles	3,130	1,944	14.94	6.11	11.76%	9.21%
Highway Mobile Sources			62.47	30.30	49.16%	45.63%
Other Area and Point Sources			49.66	29.99	39.08%	45.16%
All Area and Point Sources			127.07	66.41	100.00%	100.00%

Table G-13.

EMISSION INVENTORY SUMMARY

Geographical Area: Duluth, MN
Base Year: 1987
Last Change to Activity Levels: 05/15/91
Last Emission Factor Changes: 07/05/91

Category	CO tpy	% Total CO tpy
Farm Equipment	0	0.00%
Construction Equipment	246	0.70%
Industrial Equipment	339	0.97%
Lawn & Garden Equipment	1,285	3.67%
Off Highway Motorcycles	57	0.16%
Snowmobiles	36	0.10%
Recreational Boats	166	0.47%
Marine Vessels	3	0.01%
Nonroad Engines and Vehicles	2,132	6.10%
Highway Mobile Sources	21,603	61.77%
Other Area and Point Sources	11,237	32.13%
All Area and Point Sources	34,972	100.00%

Table G-14.

EMISSION INVENTORY SUMMARY

Geographical Area: Minneapolis/St. Paul, MN
Base Year: 1987
Last Change to Activity Levels: 05/17/91
Last Emission Factor Changes: 07/05/91

Category	CO tpy	% Total CO tpy
Farm Equipment	13,548	1.64%
Construction Equipment	17,209	2.08%
Industrial Equipment	22,040	2.67%
Lawn & Garden Equipment	33,451	4.05%
Off Highway Motorcycles	1,630	0.20%
Snowmobiles	3,249	0.39%
Recreational Boats	37,148	4.50%
Marine Vessels	28	0.00%
Nonroad Engines and Vehicles	128,302	15.54%
Highway Mobile Sources	545,808	66.09%
Other Area and Point Sources	151,775	18.38%
All Area and Point Sources	825,885	100.00%

EMISSION INVENTORY SUMMARY

Geographical Area: State of New Jersey
Base Year: 1987
Last Change to Activity Levels: 07/03/91
Last Emission Factor Changes: 07/05/91

Table G-15.

Category	HC tpy	NOx tpy	CO tpy	% Total HC tpy	% Total NOx tpy	% Total CO tpy
Farm Equipment	1,497	3,083	20,861	0.34%	0.89%	1.93%
Construction Equipment	436	2,744	5,401	0.10%	0.79%	0.50%
Industrial Equipment	5,079	9,780	89,108	1.14%	2.82%	8.25%
Lawn & Garden Equipment	2,355	83	18,124	0.53%	0.02%	1.68%
Off Highway Motorcycles	664	14	1,754	0.15%	0.00%	0.16%
Snowmobiles	142	2	209	0.03%	0.00%	0.02%
Recreational Boats	14,573	809	30,927	3.26%	0.23%	2.86%
Marine Vessels	1,608	28,205	4,648	0.36%	8.13%	0.43%
Nonroad Engines and Vehicles	26,354	44,719	171,033	5.90%	12.88%	15.84%
Highway Mobile Sources	229,246	145,139	798,091	51.32%	41.81%	73.90%
Other Area and Point Sources	191,105	157,240	110,856	42.78%	45.30%	10.26%
All Area and Point Sources	446,705	347,098	1,079,979	100.00%	100.00%	100.00%

EMISSION INVENTORY SUMMARY

Geographical Area: Beaumont-Port Arthur CMSA
Base Year: 1988
Last Change to Activity Levels: 05/30/91
Last Emission Factor Changes: 07/05/91

Table G-16.

Category	HC tpy	NOx tpy	Summer HC tpsd	Summer NOx tpsd	Summer % Total HC tpsd	Summer % Total NOx tpsd
Farm Equipment	108	342	0.30	0.94	0.07%	0.32%
Construction Equipment	424	2,670	1.16	7.32	0.26%	2.50%
Industrial Equipment	118	227	0.32	0.62	0.07%	0.21%
Lawn & Garden Equipment	24	1	0.06	0.00	0.01%	0.00%
Off Highway Motorcycles	3	0	0.01	0.00	0.00%	0.00%
Snowmobiles	0	0	0.00	0.00	0.00%	0.00%
Recreational Boats	1,012	16	2.77	0.04	0.62%	0.02%
Marine Vessels	680	15,572	1.86	42.67	0.42%	14.61%
Nonroad Engines and Vehicles	2,368	18,828	6.48	51.59	1.45%	17.66%
Highway Mobile Sources			41.20	22.10	9.23%	7.57%
Other Area and Point Sources			398.88	218.44	89.32%	74.78%
'll Area and Point Sources			446.56	292.13	100.00%	100.00%

EMISSION INVENTORY SUMMARY

Geographical Area:	Dallas-Fort Worth CMSA
Base Year:	1988
Last Change to Activity Levels:	06/04/91
Last Emission Factor Changes:	07/05/91

Table G-17.

			Summer		Summer	
Category	HC tpy	NOx tpy	HC tpsd	NOx tpsd	% Total HC tpsd	% Total NOx tpsd
Farm Equipment	1,082	3,439	2.96	9.42	0.51%	1.86%
Construction Equipment	3,052	19,209	8.36	52.63	1.43%	10.40%
Industrial Equipment	1,943	3,740	5.32	10.25	0.91%	2.03%
Lawn & Garden Equipment	252	9	0.69	0.02	0.12%	0.00%
Off Highway Motorcycles	26	1	0.07	0.00	0.01%	0.00%
Snowmobiles	0	0	0.00	0.00	0.00%	0.00%
Recreational Boats	1,830	21	5.01	0.06	0.86%	0.01%
Marine Vessels	0	0	0.00	0.00	0.00%	0.00%
Nonroad Engines and Vehicles	8,184	26,418	22.42	72.38	3.83%	14.30%
Highway Mobile Sources			324.82	269.26	55.51%	53.21%
Other Area and Point Sources			237.87	164.37	40.65%	32.48%
All Area and Point Sources			585.12	506.00	100.00%	100.00%

EMISSION INVENTORY SUMMARY

Geographical Area:	El Paso CMSA
Base Year:	1988
Last Change to Activity Levels:	05/29/91
Last Emission Factor Changes:	07/05/91

Table G-18.

				Summer		Summer		Winter	
Category	HC tpy	NOx tpy	CO tpy	HC tpsd	NOx tpsd	% Total HC tpsd	% Total NOx tpsd	CO tpwd	% Total CO tpwd
Farm Equipment	83	281	1,032	0.23	0.77	0.25%	1.04%	2.83	0.73%
Construction Equipment	669	4,212	8,279	1.83	11.54	2.04%	15.65%	22.68	5.86%
Industrial Equipment	165	318	2,899	0.45	0.87	0.50%	1.18%	7.94	2.05%
Lawn & Garden Equipment	30	1	234	0.08	0.00	0.09%	0.00%	0.64	0.17%
Off Highway Motorcycles	26	1	68	0.07	0.00	0.08%	0.00%	0.19	0.05%
Snowmobiles	0	0	0	0.00	0.00	0.00%	0.00%	0.00	0.00%
Recreational Boats	0	0	0	0.00	0.00	0.00%	0.00%	0.00	0.00%
Marine Vessels	0	0	0	0.00	0.00	0.00%	0.00%	0.00	0.00%
Nonroad Engines and Vehicles	974	4,813	12,513	2.67	13.19	2.97%	17.88%	34.28	8.86%
Highway Mobile Sources	0	0	0	53.60	35.70	59.69%	48.40%	337.10	87.15%
Other Area and Point Sources	0	0	0	33.53	24.87	37.34%	33.72%	15.41	3.98%
All Area and Point Sources	974	4,813	12,513	89.80	73.75	100.00%	100.00%	386.79	100.00%

EMISSION INVENTORY SUMMARY

Geographical Area:	Houston-Galveston-Brazoria CMSA					
Base Year:	1988					
Last Change to Activity Levels:	05/29/91					
Last Emission Factor Changes:	07/05/91					

Table G-19.

			Summer		Summer	
Category	HC tpy	NOx tpy	HC tpsd	NOx tpsd	% Total HC tpsd	% Total NOx tpsd
Farm Equipment	481	402	1.32	1.10	0.12%	0.04%
Construction Equipment	4,165	26,214	11.41	71.82	1.05%	2.67%
Industrial Equipment	1,443	2,779	3.95	7.61	0.37%	0.28%
Lawn & Garden Equipment	233	8	0.64	0.02	0.06%	0.00%
Off Highway Motorcycles	23	0	0.06	0.00	0.01%	0.00%
Snowmobiles	0	0	0.00	0.00	0.00%	0.00%
Recreational Boats	9,261	147	25.37	0.40	2.34%	0.01%
Marine Vessels	1,149	26,327	3.14	72.13	0.29%	2.69%
Nonroad Engines and Vehicles	16,755	55,878	45.90	153.09	4.24%	5.70%
Highway Mobile Sources			257.40	1,673.90	23.77%	62.31%
Other Area and Point Sources			779.54	859.40	71.99%	31.99%
All Area and Point Sources			1,082.84	2,686.39	100.00%	100.00%

EMISSION INVENTORY SUMMARY

Geographical Area:	Puget Sound (Seattle), WA
Base Year:	1988
Last Change to Activity Levels:	06/10/91
Last Emission Factor Changes:	07/05/91

Table G-20.

Category	CO tpy	% Total CO tpy
Farm Equipment	1,142	0.14%
Construction Equipment	10,672	1.27%
Industrial Equipment	19,774	2.35%
Lawn & Garden Equipment	13,079	1.56%
Off Highway Motorcycles	1,514	0.18%
Snowmobiles	418	0.05%
Recreational Boats	23,157	2.76%
Marine Vessels	4,108	0.49%
Nonroad Engines and Vehicles	73,864	8.79%
Highway Mobile Sources	532,242	63.34%
Other Area and Point Sources	234,161	27.87%
and Point Sources	840,266	100.00%

Table G-21.

EMISSION INVENTORY SUMMARY

Geographical Area: **Mountain Counties Air Basin**

Category	VOC tpd	NOx tpd	CO tpd	PM tpd
Farm Equipment	0.87	3.48	11.97	0.16
Non-Farm Equipment	4.70	20.36	60.44	0.95
Lawn & Garden Equipment	1.60	0.08	11.13	0.04
Off Highway Vehicles				
Marine Vessels	0.00	0.00	0.00	0.00
Nonroad engines and vehicles (*)	7.17	23.92	83.54	1.15
Aircraft	0.10	0.00	0.00	0.00
Railroads	1.10	3.80	1.30	0.30
All Nonroad Mobile Sources	8.37	27.72	84.84	1.45
Highway Mobile Sources	25.00	30.00	180.00	4.20
Other Area and Point Sources	120.00	20.00	1,100.00	380.00
All Area and Point Sources	153.37	77.72	1,364.84	385.65

Category	% Total VOC tpd	% Total NOx tpd	% Total CO tpd	% Total PM tpd
Nonroad Mobile Sources				
Farm Equipment	0.57%	4.48%	0.88%	0.04%
Non-Farm Equipment	3.06%	26.20%	4.43%	0.25%
Lawn & Garden Equipment	1.04%	0.10%	0.82%	0.01%
Off Highway Vehicles	0.00%	0.00%	0.00%	0.00%
Marine Vessels	0.00%	0.00%	0.00%	0.00%
Nonroad engines and vehicles (*)	4.67%	30.77%	6.12%	0.30%
Aircraft	0.07%	0.00%	0.00%	0.00%
Railroads	0.72%	4.89%	0.10%	0.08%
All Nonroad Mobile Sources	5.46%	35.66%	6.22%	0.38%
Highway Mobile Sources	16.30%	38.60%	13.19%	1.09%
Other Area and Point Sources	78.24%	25.73%	80.60%	98.53%
All Area and Point Sources	100.00%	100.00%	100.00%	100.00%

Notes

(*) excludes railroad locomotives and aircraft

Table G-22.

EMISSION INVENTORY SUMMARY

Geographical Area: Sacramento Valley Air Basin

Category	VOC tpd	NOx tpd	CO tpd	PM tpd
Farm Equipment	4.18	16.72	57.48	0.78
Non-Farm Equipment	6.67	28.89	85.79	1.35
Lawn & Garden Equipment	4.00	0.18	27.70	0.09
Off Highway Vehicles				
Marine Vessels	0.27	3.41	0.47	0.21
Nonroad engines and vehicles (*)	15.12	49.20	171.44	2.43
Aircraft	3.10	2.10	21.10	0.40
Railroads	5.80	20.00	7.50	1.30
All Nonroad Mobile Sources	24.02	71.30	200.04	4.13
Highway Mobile Sources	130.00	160.00	900.00	23.00
Other Area and Point Sources	210.00	33.00	660.00	830.00
All Area and Point Sources	364.02	264.30	1,760.04	857.13

Category	% Total VOC tpd	% Total NOx tpd	% Total CO tpd	% Total PM tpd
Nonroad Mobile Sources				
Farm Equipment	1.15%	6.33%	3.27%	0.09%
Non-Farm Equipment	1.83%	10.93%	4.87%	0.16%
Lawn & Garden Equipment	1.10%	0.07%	1.57%	0.01%
Off Highway Vehicles	0.00%	0.00%	0.00%	0.00%
Marine Vessels	0.07%	1.29%	0.03%	0.02%
Nonroad engines and vehicles (*)	4.15%	18.62%	9.74%	0.28%
Aircraft	0.85%	0.79%	1.20%	0.05%
Railroads	1.59%	7.57%	0.43%	0.15%
All Nonroad Mobile Sources	6.60%	26.98%	11.37%	0.48%
Highway Mobile Sources	35.71%	60.54%	51.14%	2.68%
Other Area and Point Sources	57.69%	12.49%	37.50%	96.83%
All Area and Point Sources	100.00%	100.00%	100.00%	100.00%

Notes

(*) excludes railroad locomotives and aircraft

Table G-23.

EMISSION INVENTORY SUMMARY
Geographical Area: San Diego Air Basin

Category	VOC tpd	NOx tpd	CO tpd	PM tpd
Farm Equipment	0.15	0.58	2.00	0.03
Non-Farm Equipment	6.86	29.71	88.20	1.39
Lawn & Garden Equipment	5.40	0.25	37.60	0.13
Off Highway Vehicles				
Marine Vessels	2.50	41.11	6.75	2.34
Nonroad engines and vehicles (*)	14.91	71.65	134.55	3.89
Aircraft	3.50	4.10	19.10	0.90
Railroads	0.30	1.00	0.30	0.10
All Nonroad Mobile Sources	18.71	76.75	153.95	4.89
Highway Mobile Sources	150.00	140.00	980.00	19.00
Other Area and Point Sources	330.00	29.00	160.00	490.00
All Area and Point Sources	498.71	245.75	1,293.95	513.89

Category	% Total VOC tpd	% Total NOx tpd	% Total CO tpd	% Total PM tpd
Nonroad Mobile Sources				
Farm Equipment	0.03%	0.24%	0.15%	0.01%
Non-Farm Equipment	1.38%	12.09%	6.82%	0.27%
Lawn & Garden Equipment	1.08%	0.10%	2.91%	0.03%
Off Highway Vehicles	0.00%	0.00%	0.00%	0.00%
Marine Vessels	0.50%	16.73%	0.52%	0.46%
Nonroad engines and vehicles (*)	2.99%	29.16%	10.40%	0.76%
Aircraft	0.70%	1.67%	1.48%	0.18%
Railroads	0.06%	0.41%	0.02%	0.02%
All Nonroad Mobile Sources	3.75%	31.23%	11.90%	0.95%
Highway Mobile Sources	30.08%	56.97%	75.74%	3.70%
Other Area and Point Sources	66.17%	11.80%	12.37%	95.35%
All Area and Point Sources	100.00%	100.00%	100.00%	100.00%

Notes
(*) excludes railroad locomotives and aircraft

Table G-24.

EMISSION INVENTORY SUMMARY

Geographical Area: San Francisco Bay Area Air Basin

Category	VOC tpd	NOx tpd	CO tpd	PM tpd
Farm Equipment	1.26	5.05	17.36	0.23
Non-Farm Equipment	11.46	48.99	148.59	2.29
Lawn & Garden Equipment	15.00	0.70	104.90	0.36
Off Highway Vehicles				
Marine Vessels	7.00	81.45	11.77	5.69
Nonroad engines and vehicles (*)	34.72	136.19	282.62	8.57
Aircraft	20.10	18.20	77.00	0.30
Railroads	1.30	5.30	2.00	2.60
All Nonroad Mobile Sources	56.12	159.69	361.62	11.47
Highway Mobile Sources	300.00	340.00	2,000.00	48.00
Other Area and Point Sources	1,200.00	160.00	250.00	1,000.00
All Area and Point Sources	1,556.12	659.69	2,611.62	1,059.47

Category	% Total VOC tpd	% Total NOx tpd	% Total CO tpd	% Total PM tpd
Nonroad Mobile Sources				
Farm Equipment	0.08%	0.77%	0.66%	0.02%
Non-Farm Equipment	0.74%	7.43%	5.69%	0.22%
Lawn & Garden Equipment	0.96%	0.11%	4.02%	0.03%
Off Highway Vehicles	0.00%	0.00%	0.00%	0.00%
Marine Vessels	0.45%	12.35%	0.45%	0.54%
Nonroad engines and vehicles (*)	2.23%	20.64%	10.82%	0.81%
Aircraft	1.29%	2.76%	2.95%	0.03%
Railroads	0.08%	0.80%	0.08%	0.25%
All Nonroad Mobile Sources	3.61%	24.21%	13.85%	1.08%
Highway Mobile Sources	19.28%	51.54%	76.58%	4.53%
Other Area and Point Sources	77.11%	24.25%	9.57%	94.39%
All Area and Point Sources	100.00%	100.00%	100.00%	100.00%

Notes

(*) excludes railroad locomotives and aircraft

Table G-25.

EMISSION INVENTORY SUMMARY

Geographical Area: San Joaquin Valley Air Basin

Category	VOC tpd	NOx tpd	CO tpd	PM tpd
Farm Equipment	8.96	35.80	123.05	1.68
Non-Farm Equipment	7.06	30.56	90.75	1.42
Lawn & Garden Equipment	6.00	0.28	42.10	0.14
Off Highway Vehicles				
Marine Vessels	0.22	2.64	0.35	0.17
Nonroad engines and vehicles (*)	22.24	69.28	256.25	3.41
Aircraft	15.60	4.70	75.00	3.40
Railroads	6.50	22.00	8.20	1.50
All Nonroad Mobile Sources	44.34	95.98	339.45	8.31
Highway Mobile Sources	150.00	240.00	1,100.00	37.00
Other Area and Point Sources	1,000.00	220.00	600.00	2,000.00
All Area and Point Sources	1,194.34	555.98	2,039.45	2,045.31

Category	% Total VOC tpd	% Total NOx tpd	% Total CO tpd	% Total PM tpd
Nonroad Mobile Sources				
Farm Equipment	0.75%	6.44%	6.03%	0.08%
Non-Farm Equipment	0.59%	5.50%	4.45%	0.07%
Lawn & Garden Equipment	0.50%	0.05%	2.06%	0.01%
Off Highway Vehicles	0.00%	0.00%	0.00%	0.00%
Marine Vessels	0.02%	0.47%	0.02%	0.01%
Nonroad engines and vehicles (*)	1.86%	12.46%	12.56%	0.17%
Aircraft	1.31%	0.85%	3.68%	0.17%
Railroads	0.54%	3.96%	0.40%	0.07%
All Nonroad Mobile Sources	3.71%	17.26%	16.64%	0.41%
Highway Mobile Sources	12.56%	43.17%	53.94%	1.81%
Other Area and Point Sources	83.73%	39.57%	29.42%	97.78%
All Area and Point Sources	100.00%	100.00%	100.00%	100.00%

Notes

(*) excludes railroad locomotives and aircraft

Table G-26.

EMISSION INVENTORY SUMMARY

Geographical Area: South Central Coast Air Basin

Category	VOC tpd	NOx tpd	CO tpd	PM tpd
Farm Equipment	2.36	9.43	32.40	0.44
Non-Farm Equipment	2.53	10.96	32.55	0.51
Lawn & Garden Equipment	2.80	0.13	19.80	0.07
Off Highway Vehicles				
Marine Vessels	0.00	0.00	0.00	0.00
Nonroad engines and vehicles (*)	7.69	20.52	84.75	1.02
Aircraft	2.20	0.90	15.30	0.40
Railroads	1.40	4.80	1.70	0.30
All Nonroad Mobile Sources	11.29	26.22	101.75	1.72
Highway Mobile Sources	71.00	84.00	490.00	11.00
Other Area and Point Sources	330.00	54.00	130.00	350.00
All Area and Point Sources	412.29	164.22	721.75	362.72

Category	% Total VOC tpd	% Total NOx tpd	% Total CO tpd	% Total PM tpd
Nonroad Mobile Sources				
Farm Equipment	0.57%	5.74%	4.49%	0.12%
Non-Farm Equipment	0.61%	6.67%	4.51%	0.14%
Lawn & Garden Equipment	0.68%	0.08%	2.74%	0.02%
Off Highway Vehicles	0.00%	0.00%	0.00%	0.00%
Marine Vessels	0.00%	0.00%	0.00%	0.00%
Nonroad engines and vehicles (*)	1.87%	12.50%	11.74%	0.28%
Aircraft	0.53%	0.55%	2.12%	0.11%
Railroads	0.34%	2.92%	0.24%	0.08%
All Nonroad Mobile Sources	2.74%	15.97%	14.10%	0.47%
Highway Mobile Sources	17.22%	51.15%	67.89%	3.03%
Other Area and Point Sources	80.04%	32.88%	18.01%	96.49%
All Area and Point Sources	100.00%	100.00%	100.00%	100.00%

Notes

(*) excludes railroad locomotives and aircraft

Table G-27

EMISSION INVENTORY SUMMARY

Geographical Area: South Coast Air Basin

Category	VOC tpd	NOx tpd	CO tpd	PM tpd
Farm Equipment	0.50	6.14	2.01	0.09
Non-Farm Equipment	28.55	123.65	367.13	5.78
Lawn & Garden Equipment	29.20	1.36	203.90	0.70
Off Highway Vehicles				
Marine Vessels	7.33	68.38	10.43	4.15
Nonroad engines and vehicles (*)	65.58	199.53	583.52	10.72
Aircraft	18.70	16.70	83.00	3.30
Railroads	4.60	18.00	7.00	1.10
All Nonroad Mobile Sources	88.88	234.23	673.52	15.12
Highway Mobile Sources	650.00	660.00	4,300.00	95.00
Other Area and Point Sources	1,400.00	280.00	220.00	2,100.00
All Area and Point Sources	2,138.88	1,174.23	5,193.52	2,210.12

Category	% Total VOC tpd	% Total NOx tpd	% Total CO tpd	% Total PM tpd
Nonroad Mobile Sources				
Farm Equipment	0.02%	0.52%	0.04%	0.00%
Non-Farm Equipment	1.33%	10.53%	7.07%	0.26%
Lawn & Garden Equipment	1.37%	0.12%	3.93%	0.03%
Off Highway Vehicles	0.00%	0.00%	0.00%	0.00%
Marine Vessels	0.34%	5.82%	0.20%	0.19%
Nonroad engines and vehicles (*)	3.07%	16.99%	11.24%	0.49%
Aircraft	0.87%	1.42%	1.60%	0.15%
Railroads	0.22%	1.53%	0.13%	0.05%
All Nonroad Mobile Sources	4.16%	19.95%	12.97%	0.68%
Highway Mobile Sources	30.39%	56.21%	82.80%	4.30%
Other Area and Point Sources	65.45%	23.85%	4.24%	95.02%
All Area and Point Sources	100.00%	100.00%	100.00%	100.00%

Notes

(*) excludes railroad locomotives and aircraft

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5. U.S. Environmental Protection Agency. *State Estimates of Nonroad Engine and Vehicle Emissions*. Public Docket A-91-24. August, 1991.

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7. Energy and Environmental Analysis, Inc. *Feasibility of Controlling Emissions from Off-Road, Heavy-Duty Construction Equipment*. Final Report to the California Air Resources Board. Arlington, VA, December 1988.

8. Booz Allen & Hamilton, Inc. *Inventory of Air Pollutant Emissions From Marine Vessels*. Final Report to the California Air Resources Board, Los Angeles, CA, March 1991.

Appendix H. List of Equipment Types

EPA considered over 80 different equipment types in this study of emissions from nonroad sources. Some of these equipment types include more than one kind of equipment. For example, "aerial lifts" includes boom lifts and scissor lifts, and "commercial turf equipment" includes riding turf mowers, walk-behind multi-spindle mowers, and others kinds of equipment.* The equipment types included in each of 10 equipment categories are detailed below.

Lawn and Garden Equipment

- trimmers/edgers/brush cutters
- lawnmowers
- leaf blowers/vacuums
- rear engine riding mowers
- front mowers
- chain saws < 4 hp
- shredders < 5 hp
- tillers < 5 hp
- lawn and garden tractors
- wood splitters
- snowblowers
- chippers/stump grinders
- commercial turf equipment
  - hydro/seeder mulchers
  - riding turf mowers
  - thatchers/aerators
  - walk-behind multi-spindle mowers
  - other miscellaneous equipment
- other lawn and garden equipment
  - augers
  - sickel bar mowers
  - pruning towers
  - turf cutters

Airport Service Equipment

- aircraft support equipment
  - aircraft load lifters
  - de-icing equipment/heat and start units
  - ground power units
  - utility service equipment
  - baggage conveyors
  - airport service vehicles

- terminal tractors
  - push-back tractors
  - tow tractors
  - yard spotters

Recreational Equipment

- all terrain vehicles (ATVs)
- minibikes
- off-road motorcycles
- golf carts
- snowmobiles
- specialty vehicles/carts
  - snow grooming equipment
  - ice maintenance equipment
  - go-carts
  - industrial ATVs
  - industrial personnel carriers

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*Note that this appendix contains a slightly more detailed list of equipment than is included in the Energy and Environmental Analysis final report, "Methodology to Estimate Nonroad Equipment Populations by Nonattainment Areas," available in Docket #A-91-24.

Recreational Marine Equipment

- vessels with inboard engines
- vessels with outboard engines
- vessels with sterndrive engines
- sailboat auxiliary inboard engines
- sailboat auxiliary outboard engines

Light Commercial Equipment

- generator sets
    - baseload generators
    - co-generation generators
    - marine generators
    - military generators
    - peaking generators
    - portable generators
    - RV generators
    - stand-by generators

- pumps
    - portable pumps
    - fire pumps
    - industrial pumps
    - mud/trash pumps
    - concrete pumps
- air compressors
- gas compressors
- welders
- pressure washers

Industrial Equipment

- aerial lifts
    - boom lifts
    - scissor lifts
    - self propelled elevating platforms
- forklifts
- sweepers/scrubbers
    - municipal sweepers
    - industrial sweepers
    - scrubbers
- other general industrial equipment
    - abrasive blasting equipment
    - industrial blowers/vacuums
    - industrial scrapers/stripers
    - marine/industrial winches and hoists
    - multipurpose tool carriers
    - other miscellaneous industrial equipment
        - strippers
        - floor buffers
        - pipe corers

- other material handling equipment
    - conveyors
    - other miscellaneous material handling equipment
        - speed trucks
        - carriers
        - auto ramps

Construction Equipment

- asphalt pavers
- tampers/rammers
- plate compactors
- concrete pavers
- rollers
    - landfill compactors
    - static and vibratory rollers
- scrapers
- paving equipment
    - concrete finishers
    - concrete vibrators
    - other miscellaneous paving equipment

- surfacing equipment
    - asphalt/gravel planers
    - asphalt mixers/agitators
    - crack/joint routers
    - pumper kettles/melters
    - soil stabilizers
    - road reclaimers
    - pavement profilers
    - roofing equipment
    - other misc/surfacing equipment
- signal boards
- trenchers
    - portable/walk-behind trenchers
    - riding trenchers
    - cable layers
    - wheel trenchers

Construction Equipment (continued)

- bore/drill rigs
  - horizontal boring machines
  - self propelled drills
  - truck-mounted drills
- excavators
  - dragline excavators
  - hydraulic excavators
- concrete/industrial saws
- cement and mortar mixers
- cranes
  - pedestal cranes
  - rough terrain cranes
  - shovel-type cranes
  - straddle cranes
  - truck mounted cranes
- graders
- off-highway trucks
- crushing/processing equipment
- rough terrain forklifts
- rubber tired loaders
- rubber tired dozers
- tractors/loaders/backhoes
- crawler tractors
- skid steer loaders
- off-highway tractors
- dumpers/tenders
- other construction equipment
  - concrete pumps
  - other miscellaneous construction equipment
    - concrete breakers
    - rod benders/cutters
    - highway repair equipment

Agricultural Equipment

- 2-wheel tractors
- agricultural tractors
- agricultural mowers
- combines
- sprayers
  - back pack sprayers
  - self propelled sprayers
  - towable/tractor-mounted sprayers
  - fertilizer spreaders
- balers
- tillers > 5 hp
- swathers
- hydro power units
- other agricultural equipment
  - harvesters
  - frost/wind mills
  - forage harvesters
  - leaf harvesters
  - fruit/nut harvesters
  - orchard pruners
  - detasslers
  - cotton strippers/pickers
  - other miscellaneous agricultural equipment
    - drain augers
    - wind fans
    - bedding chippers

Logging Equipment

- chain saws > 4 hp
- shredders > 5 hp
- skidders
- fellers/bunchers
  - delimbers

Commercial Marine Vessels

- commercial marine vessels

Appendix I. Emission Factor Development

Chapter 1. Tailpipe Exhaust Emission Factors 2
- 1.1. Lawn and Garden Equipment 2
  - 1.1.1. Gasoline 2
  - 1.1.2. Diesel 3
- 1.2. Agricultural Equipment & Construction Equipment 3
  - 1.2.1. Diesel 3
  - 1.2.2. Gasoline 5
- 1.3. Logging Equipment 5
  - 1.3.1. Chain Saws > 4 hp 5
  - 1.3.2. Shredders > 5 hp 6
  - 1.3.3. Skidders and Feller/Bunchers 6
- 1.4. Industrial Equipment 6
- 1.5. Light Commercial Equipment < 50 hp 7
- 1.6. Recreational Marine 7
  - 1.6.1. Outboard Motors 7
  - 1.6.2. Inboard Gasoline 8
  - 1.6.3. Inboard Diesel 8
- 1.7. Commercial Marine Vessels 8
- 1.8. Recreational Equipment 9
  - 1.8.1. Off-Road Motorcycles 9
  - 1.8.2. Snowmobiles 10
- 1.9. Airport Service Equipment 10

Chapter 2. Adjustments to Tailpipe Emission Factors 11
- 2.1. Adjustments for Test Cycle 11
- 2.2. Adjustments for In-Use Operation 12
  - 2.2.1. 4-Stroke Gasoline Engines Under 20 hp 12
  - 2.2.2. 4-Stroke Gasoline Engines Over 20 hp 13
  - 2.2.3. 2-Stroke Gasoline Engines 13
  - 2.2.4. Diesel Engines 14

Chapter 3. Refueling and Evaporative Emission Factors 16
- 3.1. Concepts of Refueling and Evaporative Emissions 16
  - 3.1.1. Refueling Emissions 16
  - 3.1.2. Evaporative Emissions 17
- 3.2. Developing Effective Fuel Tank Volumes 17
  - 3.2.1. Gasoline Fuel Tank Volumes 18
  - 3.2.2. Diesel Fuel Tank Volumes 25
- 3.3. Methodology Used to Calculate Refueling Emission Factors 26
  - 3.3.1. Gasoline Refueling Emission Factors 26
    - Spillage 26
    - Vapor Displacement 27
  - 3.3.2. Diesel Refueling Emission Factors 30

- 3.4. Methodology Used to Calculate Evaporative Emission Factors 31
  - 3.4.1. Gasoline Evaporative Emission Factors 31
    - Diurnal 31
    - Hot Soak 32
    - Resting Loss 32
    - Running Loss 32
  - 3.4.2. Diesel Evaporative Emission Factors 32

Chapter 4. Crankcase Emission Factors 33
- 4.1. Gasoline Crankcase Emission Factors 33
- 4.2. Diesel Crankcase Emission Factors 35

Chapter 5. Benzene 37

Chapter 6. 1,3-Butadiene 38

Chapter 7. Nitrosamines 39

Tables 40

References 67

Appendix I. Emission Factor Development

This appendix details the origins of the emission factors used to calculate emission inventories for this study.

For this study, emissions from internal combustion engines are broadly grouped into one of four source categories based on the origin of the emission: tailpipe exhaust, refueling, evaporative, and crankcase emissions. Each of those categories is further divided by pollutant: HC, CO, NO_x, and other toxic pollutants including particulate matter, aldehydes, SO_x, benzene, and 1,3-butadiene. Since refueling and evaporative emissions are not a function of combustion, but are a function of fuel evaporation, only hydrocarbon emissions are considered for refueling and evaporative emissions. For each source category, pollutant, *and* nonroad equipment type (including fuel type and operating cycle), an emission factor is necessary to construct emission inventories. In simple terms, the emission factor is a measure of the rate at which a particular type of equipment emits a particular pollutant under normal operating conditions.

The remainder of this appendix describes how tailpipe exhaust, refueling, evaporative, and crankcase emission factors were developed. Adjustments were made to new engine emission factors to account for in-use effects and test cycle (steady state vs. transient) effects where appropriate. These adjustments are discussed in Chapter 2 of this appendix. Emission factors for particulate matter, aldehydes, and SO_x which were not available from the primary data sources described below were taken from AP-42[1] or from those recommended by Southwest Research Institute (SwRI).[2] Emission rates for nitrosamines, benzene, and 1,3-butadiene are discussed in separate chapters at the end of this appendix. Gasoline vapors are discussed in terms of the refueling and evaporative emissions. The emission factors used for calculating the SIP inventories are presented in Table I-01 and those used for calculating Inventories A and B are in Table I-02.

Tables I-01 through I-17 are located at the end of the appendix.

Chapter 1. Tailpipe Exhaust Emission Factors

A discussion of the development of tailpipe exhaust emission factors used in this study is presented below for the following categories: lawn and garden equipment, agricultural equipment, construction equipment, logging equipment, industrial equipment, light commercial equipment, recreational marine, commercial marine vessels, recreational equipment, and airport service equipment.

1.1. Lawn and Garden Equipment

1.1.1. Gasoline

The primary data source used in deriving the emission factors for gasoline lawn and garden equipment was the California Air Resources Board (CARB) technical support document (TSD) for lawn and garden equipment.[3] The testing done for CARB was performed by manufacturers, Southwest Research Institute (SwRI),[4] and Heiden Associates[5] for the Portable Power Equipment Manufacturers Association (PPEMA). The test results represent the most up-to-date information available for this category which were aggregated into emission factors.

The emission factors for calculating State Implementation Plan (SIP) emission inventories required aggregation of the CARB data into a 4-stroke category and a 2-stroke category. The CARB data was weighted by the population horsepower hours data submitted to EPA by the Outdoor Power Equipment Institute, the Portable Power Equipment Manufacturers Association and by data contained in the Heiden report. Tables I-03 and I-04 show this aggregation for 4-stroke and 2-stroke equipment respectively. To be used in computing SIP emission inventories, it was necessary to convert the emission factors from units of g/hp-hr to g/gallon fuel consumed. Brake specific fuel consumption (BSFC) values shown in Tables I-03 and I-04 were used for the conversion. The origin of these values is also shown in the tables. All aldehyde emission factors were derived from SAE Paper 910560, "Emission Factors for Small Utility Engines."[6]

The emission factors necessary for calculating Inventories A and B also required some aggregation, although not to the extent necessary for the SIP inventory calculation. The derivation of these emission factors is shown in Table I-05.

1.1.2. Diesel

Nearly all lawn and garden equipment is powered by gasoline engines. However, a small population of rear engine riding mowers, lawn and garden tractors, and wood splitters, chippers/stump grinders, and commercial turf equipment are powered by diesel engines. Since no emission data is available for diesel-powered lawn and garden equipment, the emission factors for diesel light commercial equipment (< 50 hp) were assumed to be the best approximation and were used for the study (see "1.5. Light Commercial Equipment < 50 hp").

1.2. Agricultural Equipment & Construction Equipment

1.2.1. Diesel

The most recent, up-to-date published emission factors for agricultural and construction diesel equipment are reported in the CAL/ERT report,[7] and in a recent report to CARB by Energy and Environmental Analysis (EEA)[8] on heavy-duty construction equipment. In general, the emissions for the CAL/ERT report were measured on a 13-mode steady state cycle and emission factors are reported in terms of equipment types. The EEA report presented general emission factors for HC, NO_X and particulate matter by model year.

In addition to these two sources, the Engine Manufacturers Association (EMA) submitted to EPA a list of recommended emission factors for diesel construction and agricultural equipment presented in Table I-06. The emission data was based on individual engine manufacturer submissions of emission data obtained from the 8-Mode Emission Test Procedure (ISO 8178) and related mode weighing factors. The emission factors were EMA's best estimates of in-the-field fleet population weighted factors. For agricultural equipment, EMA provided factors for only three equipment types (i.e. farm tractors, grain combine, and cotton pickers).

In general, the emission factors reported by the three sources are reasonably similar. For agricultural equipment, EPA has selected the factors presented in the CAL/ERT study since they are presented by specific equipment type. For the SIP inventories, the emission factors were aggregated to tractor and nontractor categories by the energy outputs reported in the CAL/ERT report. The factors were converted from units of g/hp-hr to lb/1000 gallons of fuel consumed by using a BSFC of 0.4 lb/Hp-hr[9] and diesel fuel density of 7.1 lb/gallon.[10] Table I-08 shows the aggregation of the emission factors in terms of g/hp-hr, while Table I-08 shows the lb/1000 gal derivation.

For construction equipment the EMA emission factors were selected to be used to calculate emission inventories. For some equipment types, EMA factors were not available. In these cases, the Fourth Edition of AP-42[11] factors which were derived from CAL/ERT[12] factors were used. Table I-9 compares the AP-42 (CAL/ERT) and EMA emission factors for construction equipment.

The EMA did not report emission factors for particulate matter. The emission factors for particulate matter and aldehydes used in the study for Inventory A are those reported in the Fourth Edition of AP-42. The test results from a recent joint EPA/Industry program to assess test cycles for nonroad equipment are presented in Table I-10. The particulate emissions from the four 1991 diesel nonroad engines tested suggest that these newer engines have considerably lower emission rates than the emission factors reported in AP-42 (which are derived from a 1973 Southwest Research Institute study)[13]. Particulate emission rates for the four new engines tested are two to five times lower than the emission factors used for inventory purposes. Therefore, as the older engine fleet is replaced by the newer engines which emit lower levels of particulate matter, the particulate emission inventory will decrease accordingly. Although, the emission factors reported in AP-42 are assumed by EPA to be more representative of the average engine in the population, the test results on new engines suggest that these emission factors may overestimate particulate emission rates. To some extent, technology improvements in highway engines to meet the particulate emission standards (beginning in 1988) may have been carried into nonroad versions of these engines with the accompanying particulate emission benefit. Also, the data from the EPA/Industry program indicate that engine manufacturers who do not produce engines for highway applications have shown a decrease in particulate levels from 1973 to 1991.

The Engine Manufacturers Association (EMA) expressed concerns regarding the representativeness of the AP-42 data which was generated in 1973. As a result, the particulate matter emission factors used for Inventory B are the equally weighted average of the AP-42 emission factors and the 1991 EPA/Industry average 8-mode nonroad engine test data.

1.2.2. Gasoline

The emission factors for gasoline agricultural and construction equipment selected to be used in calculating emission inventories are from the Fourth Edition of AP-42. The other sources that reported emission factors for diesel equipment did not report gasoline equipment emission factors. The CAL/ERT report did suggest using 2.8 g/hp-hr HC, 163 g/hp-hr CO, and 7.8 g/hp-hr NO_x for gasoline powered equipment (Tables I-7(c) and I-8(c)). However, the emission factors in AP-42 are more specific to equipment type and will be used for the study.

The particulate emission factors in AP-42 were derived from particulate measurements on gasoline nonroad engines at SwRI in the mid-seventies.[14] Leaded gasolines which generally contained between 1.5 and 2 grams of lead per gallon were used for the emission tests. This high lead fuel is not commercially available today. Even today's leaded fuel contains very little lead. Since particles consisting of lead oxides are the main particulate emission from leaded-gasoline fueled engines, the AP-42 emission factors are not representative of emission rates from equipment operating on currently available gasoline. Therefore, the values reported in AP-42 were not used in this study. Instead, a value of 1.64 lb/1000 gallons was used for the particulate emission factors for gasoline fueled equipment. This value is based on a recommendation from SwRI in the *Nonroad Emission Factors of Air Toxics*[15] report to EPA. Where necessary, the 1.64 lb/1000 gallon was converted to 0.06 g/hp-hr by assuming BSFC 0.5 lb/hp-hr[16] and density of gasoline of 6.2 lb/gallon.[17] Aldehyde emission factors were taken from AP-42.

1.3. Logging Equipment

1.3.1. Chain Saws > 4 hp

The emission factors for commercial chain saws reported in the CARB TSD[18] are used for this category.

1.3.2. Shredders > 5 hp

The emission factors reported in the CARB TSD for 4-stroke commercial shredders/ grinders are used for this category.

1.3.3. Skidders and Feller/Bunchers

The diesel emission factors for log skidders submitted to EPA by EMA (Table N-6) are used for these categories.

1.4. Industrial Equipment

Emission factors for gasoline and diesel industrial equipment used for the study are those reported in Volume I of AP-42. These factors were derived by SwRI in 1973[19] and were based on tests performed on eight diesel engines and four gasoline engines. No emissions data were available for LPG-powered aerial lifts, forklifts, and sweepers/scrubbers. The only emission data found for LPG-powered equipment is from two gasoline engines which were converted to operate on LPG. One engine was a 4.5 hp overhead valve walk behind mower engine tested by Southwest Research Institute.[20] Compared to the emissions when the engine was operated on gasoline, the engine emitted 38% less HC, 55% less CO, 147% more NO_X, 13% less PM, and approximately the same level of aldehydes when operated on LPG. The other engine was a 12.5 hp utility engine tested by Onan.[21] Compared to operation on gasoline, this engine emitted 72% less HC, 80% less CO, and 347% more NO_X when operated on LPG. Since neither of these engines are representative of the larger industrial equipment engines, the emission data cannot directly be used for developing an emission factor. However, the relative differences between the gasoline and LPG emission results for the two engines can be used to approximate the LPG emission factor. The above percentages were averaged resulting in a 55% reduction in HC, a 68% reduction in CO, a 247% increase in NO_X, and a 13% reduction in particulate matter compared to the gasoline baseline emission values when an engine is operated on propane. These percentages were applied to the gasoline emission factors to approximate the LPG emission factors.

1.5. Light Commercial Equipment < 50 hp

Light commercial equipment includes generator sets, pumps, air compressors, gas compressors, welders, and pressure washers. The emission factors recommended by SwRI[22] for the continuous service diesel equipment will be used for the study. These factors are the refrigeration unit emission factors in the Radian report[23]. Emission factors for gasoline light commercial equipment to be used in the study are taken from the CARB technical support document for utility and lawn and garden equipment[24] for *large* engines. Engines tested to develop the *large* engine emission factors included a 16 hp single cylinder side valve engine and two 18 hp 2-cylinder side valve engines. No emissions data were available for LPG powered pumps and gas compressors. Therefore, the gasoline emission factors for these equipment types were decreased by 55% for HC, decreased by 68% for CO, increased by 247% for NO_X, and decreased by 13% for particulate matter to approximate the LPG emission factors. This methodology is discussed in "1.4. Industrial Equipment" above.

1.6. Recreational Marine

1.6.1. Outboard Motors

The emission factors for outboard motors used in the study are derived from data submitted to EPA by the National Marine Manufacturers Association (NMMA). Data were submitted for twenty-five 2-stroke outboard engines and three 4-stroke outboard engines tested using the International Counsel of Marine Industry Associations (ICOMIA) Standard No. 36-88 duty cycle.[25] To aggregate the HC, CO, and NO_X emission factors on a national level for 2-stroke outboard engines, the horsepower distributions for the eight areas of the Broh survey[26] were used. The brake specific emission data supplied by NMMA were grouped into the horsepower ranges consistent with the Broh survey and averaged within each range. These data were then combined as shown in Table I-11a using the survey distributions. The resulting emission factors are in fuel based units (grams/gallon). The 4-stroke outboard emission data supplied by NMMA were aggregated as shown in Table I-11b.

Particulate matter, aldehyde, and oxides of sulfur emissions were not measured from the engines tested by NMMA, therefore other data was used to determine the emission factors for these pollutants. For 4-stroke outboards, the particulate matter and aldehyde (also used for 2-stroke) emission factors for noncatalyst gasoline engines recommended by Southwest Research Institute (SwRI)[27] were used. For 2-stroke outboards, no data on particulate emission rates was available. The particulate emission factors for 2-stroke utility engines of 7.7 g/hp-hr from the CARB technical support document for utility and lawn and garden equipment were used to approximate rates for outboard engines.[28] A brake specific fuel consumption value of 0.16 gallon/hp-hr was calculated from data supplied by NMMA and the Broh study distributions and used to convert the emission factor units to grams/gallon. For SO_X, emission factors for gasoline marine pleasurecraft in AP-42[29] were used.

1.6.2. Inboard Gasoline

The HC, CO, and NO_X emission factors used in the study for gasoline inboard and sterndrive engines were derived from data supplied by NMMA. The NMMA supplied emissions data for three 4-stroke gasoline marine inboard/sterndrive engines which were combined as shown in Table I-11c to determine emission rates in terms of grams/gallon of fuel consumed. The particulate emission factor used was 1.64 lb/1000 gal (0.74 g/gallon) as described in Section 1.2.2. of this appendix. The aldehyde emission factors for noncatalyst gasoline engines recommended by Southwest Research Institute (SwRI) and the SO_X emission factors reported in AP-42 were used for inboard/sterndrive gasoline engines.

1.6.3. Inboard Diesel

The HC, CO, and NO_X emission factors used in the study for diesel inboard engines were derived from data supplied by NMMA. The NMMA supplied data for one small sailboat inboard and three larger diesel inboards. The data were combined as shown in Table 11d to determine emission factors in terms of grams/gallon.

1.7. Commercial Marine Vessels

The AP-42 guidance document subdivides commercial motorships into waterway classifications for the purpose of calculating SIP emission inventories. The classifications are: coastal, great lakes, and river. The vessels operating in each of these waterways have similar characteristics such as size, speed, engine design, and distance traveled. Emission factors for these classifications are contained in AP-42. These factors are used by states for calculating emission inventories by the fuel sales method described in the *Procedures for Emission Inventory Preparation, Volume IV: Mobile Sources*[30] guidance document published by EPA. Another set of emission factors for calculating emission inventories using a different method (the ship movement data method) is contained in the guidance document. The factors are in terms of size categories (draft). The emission factors used for the SIP inventory calculations are those reported in AP-42 and the guidance document with the exception of the slow speed diesel emission factors. For slow speed diesel marine engines, the emission factor of 550 lb/1000 gallons reported in the recent Booz Allen & Hamilton study[31] for EPA are used. This source is thought to better represent actual NO_X emission factors for the reasons set forth in the report. Emission factors for medium speed diesels were also reported by Radian[32] to CARB in 1988. These factors were based on tests of locomotive engines. The NO_X emission factor reported by Radian is 533 lb/1000 gal which is substantially higher than the factors reported in AP-42 (approx. 300 lb/1000 gal).

The commercial marine vessel inventories used for nonroad inventories A and B were developed by Booz Allen & Hamilton under contract for EPA. The emission factors used are contained in the Booz Allen & Hamilton final report and are reproduced in Tables I-12a and I-12b.

1.8. Recreational Equipment

1.8.1. Off-Road Motorcycles

As part of a recent CARB proposal to control emissions from off-road motorcycles,[33] CARB calculated emission factors for 2-stroke and 4-stroke engines. The factors are shown in Table I-13. To calculate SIP inventories, these factors were aggregated into composite factors by using a 68.5% 2-stroke, 31.5% 4-stroke distribution provided by EEA. The 2-stroke and 4-stroke emission factors for off-road motorcycles were also assumed for all terrain vehicles, minibikes, golf carts, and specialty vehicle carts.

1.8.2. Snowmobiles

Very little data exists on emission rates from snowmobiles. The best currently available published data appears to be contained in AP-42. These emission factors were derived from testing performed by SwRI in 1974[34] and are being considered for the study. The factors in terms of g/hr were converted to g/hp-hr for use in calculating emissions inventories from the activity information provided by EEA. The power reported by SwRI for the various test engines was weighted in the same manner as the emission values to determine a composite power of 5.8 hp over the test cycle. The g/hr value was then divided by 5.8 to determine g/hp hr. In a recent response to CARB mail out #90-70 entitled *A Proposal to Establish Exhaust Emission Standards and Test Procedures for Off-Highway Light-Duty Vehicles and Recreational Vehicles*, the International Snowmobile Industry Association (ISIA) reported snowmobile emission factors of 216 g/hp-hr HC+NO_x, and 564 g/hp-hr for CO. These factors are substantially higher than those calculated from the AP-42 factors even though the same SwRI test procedures were used in both cases.

1.9. Airport Service Equipment

The emission factors for industrial equipment were assumed to apply to airport service equipment.

Chapter 2. Adjustments to Tailpipe Emission Factors

2.1. Adjustments for Test Cycle

To develop emission factors representative of in-use nonroad engines, the test cycle that the engines are operated on should simulate typical in-use operation. There is much debate regarding the appropriateness of using a steady state test cycle or a transient test cycle for emission testing nonroad engines. A steady state test is a series of fixed set points of speed and load held for a period of time (usually from two to ten minutes). Emission measurements are made at the end of the period when readings have stabilized. Currently, a transient cycle is used to certify heavy-duty highway engines. It is a continuously varying cycle of speeds and loads which may have brief periods of steady state operation. Emission measurements are made continuously over all points.

The emission factors submitted by EMA for nonroad equipment were based on data generated using a standardized 8-mode steady state test cycle. The 8-mode test cycle does not measure emissions during transition and stabilization between modes. This could understate the emissions of equipment that encounters transient operation in use. This is especially true for particulate emissions, for which the 8-mode cycle does not provide a good measurement for equipment that encounters transient operation. On the other hand, the transient cycle used to simulate highway heavy-duty engine operation may not be as appropriate to simulate nonroad equipment transient operation. However, EPA expects that emission levels of nonroad equipment that encounters transient operation in use will be better represented by levels during the highway transient test.

For diesel powered equipment expected to encounter either transient speed or transient load conditions in-use, EPA adjusted the emission factors that were generated using a steady state cycle. Data from a joint EPA/Industry program to assess test cycles for nonroad equipment was used to determine the ratio of the FTP transient test emissions to the 8-mode steady state test emissions (Table I-10). Based on the currently available data (four engines) these ratios were: 1.4 for HC, 2.0 for CO, 1 for NO_x, and 1.6 for particulates. These ratios were then applied to the emission factors of diesel fueled equipment types that are expected to encounter transient operation in-use. Test cycle adjustments were not made to emission factors of gasoline fueled equipment types as there was no available data on transient versus steady state test cycle emission comparisons for gasoline fueled engines.

2.2. Adjustments for In-Use Operation

The emission factors contained in Tables I-02a, I-02b, and I-02d were developed using data from testing new engines. Although many of the test procedures used for emission testing required an engine break-in period, the tests performed on new engines do not account for in-use impacts on emissions from engine malfunctions, improper maintenance, and engine wear. To assess the magnitude of these impacts, EPA contracted with Southwest Research Institute (SwRI) to emission test small in-use utility engines. EPA also used existing data on pre-controlled heavy-duty engines to estimate in-use impacts on emission factors.

Southwest Research Institute procured five in-use utility engines (three 4-stroke engines and two 2-stroke engines) and performed emission tests using the SAE J1088 procedure. A description of the engines and the emission test results are shown in Table I-14. The table also shows the emission factors used for the respective equipment types which were derived from new, properly operating engines. The ratio of the in-use engine test emissions to the new engine emission factor is also shown in the table and these values were averaged to determine an in-use adjustment factor which can be applied to new engine emission factors.

2.2.1. 4-Stroke Gasoline Engines Under 20 hp

The 4-stroke engines tested by SwRI showed 2.1 times the HC emissions, 1.9 times the CO emissions, 0.4 times the NO_x emissions, and 3.6 times the particulate emissions of new engine emissions (Table I-14). These engines exhibited problems of low power, head gasket leaks and others which are described in the SwRI report.[35] Although only a very small sample of 4-stroke engines were tested, the trend of high HC, CO, and particulates and low NO_x was consistent. Thus, the adjustment factors were applied to the emission factors of gasoline 4-stroke engines less than 20 hp. The resulting emission factors (Table I-02c) represent a rough approximation of in-use nonroad engine emission levels.

2.2.2. 4-Stroke Gasoline Engines Over 20 hp

In 1983, the Engine Manufacturers Association (EMA) and the EPA conducted a joint in-use test program to develop in-use emission factors for heavy-duty diesel and heavy-duty gasoline engines. The program used 1979 and 1982 model year pre-controlled engines and is the best available source of data for representing in-use nonroad engine emissions. Using this data, a linear regression analysis was performed and the emissions as a function of mileage was plotted. To estimate the in-use adjustment factors some broad assumptions were made. Typical in-use engines were assumed to be have accumulated 55,000 miles, which is half of the useful life of 110,000 miles defined in the regulations for heavy-duty highway gasoline engines. The regression analysis was then used to calculate an in-use factor by dividing the emission value at 55,000 miles by that at 0 miles. The resulting factors of 1.5 for HC and 1.3 for CO were applied to the emission factors of gasoline 4-stroke engines over 20 hp to approximate in-use emission factors (Table I-02c). The NO_X emissions showed no significant change with mileage accumulation and therefore NO_X emission factors were not adjusted. Particulate 4-stroke engine emission factors were not adjusted since no data was available.

2.2.3. 2-Stroke Gasoline Engines

As discussed above, SwRI tested two 2-stroke in-use engines. One was from a walk behind mower (WBM) application and the other was from a string trimmer application. The eleven year old WBM engine exhibited HC, CO, and PM emissions similar to the new engine emission factors shown in Table I-14. This engine produced somewhat higher NO_X emission than the new engine factors show. The string trimmer engine, on the other hand, showed extremely high HC, CO, and PM levels and similar NO_X levels compared to the new engine emission factors. Since only two data points were available for 2-stroke engines and these data were widely divergent, EPA did not estimate in-use adjustment factors based on these points. Instead, the factors used for 4-stroke engines less than 20 hp were used for HC and CO emissions for 2-stroke engines with average horsepower less than 20, as the 2-stroke data bracketed the 4-stroke results for these pollutants (i.e., one data point was much lower and one was much higher). The 4-stroke NO_X adjustment factor of 0.4 did not seem appropriate to apply to 2-strokes since both the 2-stroke engines tested by SwRI showed nearly equal or higher emission levels than new engine emission factors. Therefore, no adjustment was made to NO_x new engine emission factors. Also, the 4-stroke particulate adjustment factor of 3.6 did not seem appropriate since the new engine emission factor used as numerator of the factor ratio was very small compared to the new emission factor value for 2-stroke engines. Therefore, no adjustment was made to the 2-stroke particulate new engine emission factor. For 2-stroke engines with average horsepower greater than 20, the adjustment factors for 4-strokes greater than 20 hp were used.

For 2-stroke outboard marine engines, these adjustments for HC and CO emissions would likely overstate in-use effects due to the more unique characteristics of these engines. Outboard engines are built to be more durable than the smaller, less expensive utility/lawn and garden engines, and to operate in environments where airborne dust and dirt are less of a problem. Therefore, an adjustment factor of 1.2 was applied to HC and CO for 2-stroke outboard engines.

The National Marine Manufacturer Association suggests that in-use adjustment factors for 2-stroke outboard engines should not be included in the calculation of emission inventories until further investigation can be done. NMMA states that 2-stroke engines do not exhibit the same deterioration in efficiency after extended use as 4-stroke engines and that boaters are more likely to maintain their engines for safety reasons. Also, an NMMA member company recently compiled data on an 8-horsepower, 2-stroke outboard that had accumulated 2,500 hours on the company's durability cycle which showed no increase in specific emission. However, EPA expects that using new engine emission factors for calculating in-use inventories would understate actual in-use emission levels. The in-use adjustment factors for 4-stroke gasoline engines greater than 20 hp were adjusted downward by a factor of about 2 as an estimation of the in-use adjustment for 2-stroke outboard engines. For the in-use estimate, an adjustment factor of 1.2 was applied to HC and CO for 2-stroke outboard engine emission factors.

2.2.4. Diesel Engines

As discussed earlier, EMA and EPA conducted a joint program to assess the emission factors of pre-controlled heavy-duty diesel and gasoline engines. For diesel engines, the data showed no increase in HC, NO_x, and only a slight increase in particulate matter emissions with vehicle mileage. Therefore, the new engine diesel emission factors were not adjusted for in-use effects.

Chapter 3. Refueling and Evaporative Emission Factors

Hydrocarbon (HC) refueling and evaporative emission factors are presented in this section. A list of nonroad equipment and their evaporative and refueling emission factors may be found in Tables I-01, I-02, I-15 and I-16. Table I-15 and I-16 are also good summaries of how refueling and evaporative emission factors were calculated for gasoline and diesel fueled equipment, respectively.

This chapter is divided into four sections that (1) introduce the concept of refueling and evaporative emissions, (2) present fuel tank volume data, (3) present *refueling* emission factors, and (4) present *evaporative* emission factors. Fuel tank volumes are discussed separately to avoid duplication of discussion in the sections on refueling and evaporative emission factor methodology and data.

3.1. Concepts of Refueling and Evaporative Emissions

The concepts of refueling and evaporative emissions are now presented. These concepts are applicable to both gasoline and diesel fueled equipment (although perhaps more pertinent to gasoline fueled equipment than diesel fueled equipment).

3.1.1. Refueling Emissions

There are two components of refueling emissions: spillage and vapor displacement. Spillage emissions, or simply *spillage*, are those emissions that result from fuel spilled during the refueling process. For example, spillage includes those vapors generated from fuel spilled while filling a storage container from a gas station pump and vapors generated from fuel spilled while transferring the fuel from the storage container to the equipment. Vapor displacement emissions, or *displacement*, are those emissions that result from displacing fuel vapors in the fuel tank or storage container with liquid fuel. For example, if one gallon of gasoline is poured into a container which already contains some gasoline, one gallon of fuel vapor is displaced to the atmosphere by the incoming fuel. For the purposes of this study, *only fuel lost while refueling the equipment is considered.* One would expect, however, that refueling emissions from the refueling of storage containers would be on the same order of magnitude as the refueling emissions from equipment.

3.1.2. Evaporative Emissions

Evaporative emissions are losses generated by the evaporation of unburned fuel. Evaporative emissions do not pass through the combustion chamber. Rather, the primary sources of evaporative emissions are the carburetor and fuel tank. Similar to their on-road counterparts, evaporative emissions from nonroad sources can be subdivided into four groups: hot soak, diurnal, running loss, and resting loss emissions. Each category accounts for emissions during specific operating conditions of the equipment and specific mechanisms of emission. Hot soak emissions are those emissions which occur after the equipment has been turned off and are attributable to the elevated temperature of the equipment (e.g., evaporation from the carburetor bowl). Diurnal emissions are those fuel vapors which occur while the equipment is not operating and are attributable to natural changes in ambient conditions (temperature, pressure, etc). In addition, diurnal losses occur only during those portions of the year when the equipment is used relatively regularly (every few days).[36] Running loss emissions are those emissions which do not pass through the combustion chamber while the source is in operation. Resting loss emissions are those emissions that are not already identified by another category. For example, emissions which are due to permeation of fuel through fuel lines and fuel tank, and leakage in the fuel system are resting loss emissions. *For the purposes of this study, only diurnal emissions will be considered due to the lack of data for hot soak, resting loss and running loss emissions from nonroad engines.*

3.2. Developing Effective Fuel Tank Volumes

This section will present those data and assumptions which were used to arrive at effective fuel tank volumes for gasoline and diesel equipment. Fuel tank volumes are not discussed with the presentation of other data to avoid tedious duplication of discussion. Both evaporative and refueling emission factors use fuel tank volumes as part of their calculation.

This section, *Developing Effective Fuel Tank Volumes*, is divided into two subchapters. The first subchapter presents effective fuel tank volumes for gasoline equipment and the second subchapter presents effective fuel tank volumes for diesel equipment.

3.2.1. Gasoline Fuel Tank Volumes

Data used to calculate gasoline fuel tank volumes may be broadly categorized into two groups: data supplied by manufacturers and manufacturers' sales brochures, and data generated by EPA. Effective fuel tank volumes derived from each of these sources are discussed below.

Manufacturers' Gasoline Fuel Tank Data -- Manufacturers were asked to supply fuel tank volumes for several pieces of gasoline equipment. However, the fuel tank volumes provided often did not quite match the equipment categories used by EPA in this study and aggregation was required. When possible, a *weighted* average of pertinent fuel tank volumes was used to generate an *effective* fuel tank volume for the particular equipment category and emission source. If the data supplied by manufacturers matched an equipment category exactly, the data were used directly.

Effective fuel tank volumes are not necessarily constant for refueling and evaporative emission factor calculations. Instead, an effective fuel tank volume should be calculated for each emission and equipment type because refueling and evaporative emissions are functions of different factors. A particular weighing factor may be important when aggregating fuel tank volumes for diurnal emission factor calculations, but that same weighing factor may not be important when calculating refueling emissions, or vice-versa. For example, walk behind lawnmowers have a range of fuel tank volumes of 0.37 to 0.68 gallons. It is known that the smaller fuel tank volumes tend to be used by consumers while equipment with larger tanks tend to be used commercially. Furthermore, although there may be fewer commercial lawnmowers (large fuel tanks), their season length is probably longer. The effective fuel tank volume should account for population sizes and length of seasons. Other weighing factors are used when calculating an effective fuel tank volume for refueling emission factors. Refueling emissions are influenced by the amount of fuel consumed, which is a function of population, horsepower, load factor, brake specific fuel consumption and usage rate. The effective fuel tank volume for refueling emissions should account for these factors. Therefore, the purpose for which the average fuel tank volume is calculated dictates how individual fuel tank volumes are weighted.

The discussion below presents effective gasoline fuel tank volumes for evaporative and refueling emissions. Fuel tank aggregation for calculation of gasoline refueling emission factors are discussed first and fuel tank aggregation for calculation of gasoline evaporative emission factors are discussed afterwards. The aggregations were often reduced to mere population weighings or averages because so many weighing factors were not available (i.e., if a particular weighing factor is not known, then the category is assumed to be homogeneous with respect to that weighing factor). For this reason, gasoline fuel tank volumes used for calculation of evaporative emissions are the same as those used for refueling emission factors unless specifically indicated as different in the section titled *Manufacturer's Data for Calculation of Gasoline Evaporative Emission Factors*. In addition, several fuel tank volumes were taken directly from data supplied by manufacturers but those are not discussed below. Those data are readily identified in Table I-15.

Manufacturer's Data for Calculation of Gasoline Refueling Emission Factors -- Ideally, effective fuel tank volumes for generation of refueling emission factors are weighted by the amount of fuel consumed which is a function of population, horsepower, load factor, brake specific fuel consumption, and usage rate. As will be seen, tank volumes are very seldom weighted ideally.

Trimmers/Edgers/Brush Cutters - a straight average of fuel tank volumes from edge, hedge and string trimmers is used:

$$\frac{0.29\ gal + 0.11\ gal + 0.14\ gal}{3} = 0.18\ gal$$

Lawnmowers - a population[37] and usage[*] weighted average of consumer and commercial walk behind mowers is used:

Lawnmowers	Pop. (%)	Usage Ratio	Vol. (gal)	Product (hrs-g/yr-gal)
Consumer	95	1	0.37	35.2
Commercial	5	16	0.68	54.4
Totals	175			89.6
Effective Gas Tank Volume =			0.51	

Leaf Blowers/Vacuums - A population, usage, and horsepower weighted average[38] [†] of consumer and commercial walk behind mowers is used:

Leaf Blowers/ Vacuums	Pop. (%)	Usage (hrs/yr)	HP (hp)	L.F.	Tank Volume (gal)	Product (hrs-g-hp/ yr-gal)
Cons. Hand Held	92.83	9	.8	.47	0.16	50
Comm. Hand Held	1.84	197	.8	.47	0.16	22
Cons. Wk Behind	0.77	12	3.0	.47	0.83	11
Comm. Wk Behind	4.56	293	3.0	.47	0.83	1,564
Totals	2,347.33					1,647
Effective Gas Tank Volume =					0.70	

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[*] Consumer and commercial usage rates were supplied by OPEI in their letter of May 24, 1991, to Clare Ryan of the EPA.

[†] Walk behind blower populations are assumed to be the same as backpack blower populations.

Lawn and Garden Tractors - a population[39] and usage[40] weighted average of lawn and garden tractors is used:

Lawn and Garden Tractors	Pop. (%)	Usage (hrs/yr)	Volume (gal)	Product (hrs-g/yr-gal)
Lawn	75	40	2.25	6,750.0
Garden	25	50	3.69	4,612.5
Totals		4,250		11,362.5
Effective Gas Tank Volume =			2.67	

Generator Sets - an average of small and portable generators is used:

$$\frac{0.92\ gal + 1.13\ gal}{2} = 1.02\ gal$$

Manufacturer's Data for Calculation of Gasoline Evaporative Emission Factors

Effective fuel tank volumes used for evaporative emission factor development which are different from those shown for refueling emission factor development are listed below. Ideally, when aggregating equipment fuel tank volumes for diurnal emission factor generation, the values would be weighted by population and days of in-use season. However, days of in-use season are not available and, therefore, could not be used. This should not significantly bias the data because the aggregated equipment tend to have similar season lengths.

Walk Behind Lawnmowers - a population weighted[‡] average of values presented for consumer and commercial walk behind mowers is used:

	% Pop.		Vol.	
consumer:	95	*	.37	= .352
commercial:	5	*	.68	= .034
			Total	= .39 gal

[‡] Populations were supplied by OPEI.

Leaf Blowers/Vacuums - a population weighted[41] [8] average of consumer and commercial walk behind mowers is used:

	% Pop.		Vol.		
hand held:	93.6	*	0.16	=	0.150
walk behind:	6.4	*	0.83	=	0.053
			Total	=	0.20 gal

Lawn and Garden Tractors - a population weighted[42] average of lawn and garden tractors is used:

	% Pop.		Vol.		
lawn:	75	*	1.94	=	1.455
garden:	25	*	3.69	=	0.923
			Total	=	2.38 gal

EPA Generated Gasoline Fuel Tank Volumes -- Several fuel tank volumes were not provided by industry and alternative methods of approximating the fuel tank volumes were necessary. Three alternatives were identified to approximate missing fuel tank volume data. The first alternative is to substitute fuel tank values from equipment that use similar engines. For example, the fuel tank volume for *Generator Sets* is also used for *Signal Boards* because signal boards use generators. If a substitution is not possible or justifiable, then the second alternative is to calculate fuel tank volumes based on regression analysis. A regression of known tank volumes versus net engine horsepowers was created by EPA and is described in detail later in this subchapter. The third alternative is the use of fuel tank volumes based on the engineering judgement of EPA personnel. For all equipment, manufacturer suggested values were used when available and if not, then the first, second and third alternatives were used, respectively.

Volumes Based on Equipment with Similar Engines -- Effective fuel tank volumes which were assumed based on similar engines are shown below.

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[8] Walk behind blower populations are assumed to be the same as backpack blower populations. Consumer and commercial usage rates are assumed identical to those of lawnmowers.

Wood Splitter - assume equivalent to *Lawnmowers*[c] (0.51 gal for refueling emissions and 0.39 gal for evaporative emissions).

Commercial Turf Equipment - Wide area walk behind lawnmowers comprise the majority of this category and therefore, the wide area walk behind lawnmower fuel tank volume is used (5.0 gal). Hydro-seeders/mulchers, although a part of this category, were not incorporated into this number due to unknown weighing factors and relatively insignificant populations.

Other Lawn and Garden Equipment - assume equivalent to *Lawnmowers* (0.51 gal for refueling emissions and 0.39 gal for evaporative emissions).

Specialty Vehicles Carts - assume equivalent to *Golf Carts* (6 gal).

Air Compressors - assume equivalent to small compressors (1.13 gal).

Pressure Washers - assume equivalent to *Pumps* (0.75 gal).

Tampers/Rammers - assume equivalent to *Plate Compactors* (0.94 gal).

Rollers - assume equivalent to vibratory roller compactors (3.0 gal). Note that this is a good assumption for the gasoline portion of rollers only.

Paving Equipment - assume equivalent to vibrators/finishers (1.0 gal). Note that this is a good assumption for the gasoline portion of paving equipment only.

Surfacing Equipment - assume equivalent to *Paving Equipment* (1.0 gal).

Signal Boards - assume equivalent to *Generator Sets* (1.02 gal).

2-Wheel Tractors - assume equivalent to *Lawn and Garden Tractors* (2.67 gal for refueling emissions and 2.38 gal for evaporative emissions).

Agricultural Mowers - assume equivalent to *Lawn and Garden Tractors* (2.67 gal for refueling emissions and 2.38 gal for evaporative emissions).

Sprayers - assume equivalent to crop/turf sprayers (1.5 gal). Fertilizer spreaders were not included in this category because there is not adequate means to weigh their impact.

Volumes Based on Regression Line -- A regression of fuel tank volume versus net engine horsepower from John Deere farm, construction and utility engines was created by

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[c] The names of equipment types included in this study are italicized to distinguish them from equipment types used by manufacturers in communicating data to EPA.

EPA from John Deere product literature. The regression line is only applicable to equipment with engines of 15 hp or more. The result of that regression is:

$$\textit{Fuel Tank Vol.} = 0.51 \times \textit{Net HP} \quad ; \quad R^2 = 0.82$$

Articulated tractors and some feller-bunchers were excluded from the regression due to their exceptionally high fuel tank volumes. A list of equipment type, model, engine, net hp and fuel tank volume for all equipment used in that regression as well as a plot of the data is presented in Table I-17.

As indicated in Table I-17, most of the equipment used to create the above regression line are diesel fueled. There may be some concern that fuel tank volumes of similar diesel and gasoline equipment do not approximate each other because a particular piece of gasoline equipment tends to be smaller and have a smaller fuel tank than its diesel counterpart. This should not be the case when comparing gasoline and diesel equipment of similar horsepower. When the influence of the size of engine is removed, as done by the regression, that difference should be minimal. On the contrary, a larger mass of gasoline is required to do the same amount of work as done by a diesel fueled piece of equipment (i.e., the brake specific fuel consumption of gasoline equipment tends to be higher) and, therefore, gasoline fuel tanks would necessarily be larger to accommodate the same amount of work. Thus, use of this regression may slightly overestimate gasoline spillage emissions but underestimate gasoline diurnal emissions.

Due to the lack of data for much of the equipment, the regression line was used extensively (approximately 25% of all equipment types). The gasoline equipment for which fuel tank volumes were calculated from the regression are shown in the following (hp in parenthesis).

Chippers/Stump Grinders (62)	Cranes (55)
Aircraft Support Equipment (48)	Crushing/Proc. Equipment (60)
Vessels w/Inboard Engines (170)	Rough Terrain Forklifts (88)
Aerial Lifts (36)	Other Construction Equipment (150)
Sweepers/Scrubbers (39)	Asphalt Pavers (31)
Other General Industrial Equipment (19)	Swathers (106)
Tractors/Loaders/Backhoes (63)	Bore Drill Rigs (54)
Excavators (80)	Rubber Tired Loaders (67)
Combines (131)	Agricultural Tractors (87)
Other Materia' Handling Equipment (51)	Other Agricultural Equipment (55)

Fuel Tank Volumes Based on EPA Assumptions -- EPA was forced to make assumptions regarding the fuel tank size of *Sailboat Auxiliary Inboard Engines* (6 gal.), *Sailboat Auxiliary Outboard Engines* (6 gal.) and *Vessels w/Sterndrive Engines* (21 gal.) because data for those categories was not available. These values were presented to the National Marine Manufacturers Association (NMMA) and deemed to be acceptable estimates based on available data.[43] Estimates for the fuel tank volume of *Dumpers/Tenders*, *Terminal Tractors*, and *Hydro Power Units* were also required. *Dumpers/Tenders* were assumed to have fuel tank volumes of 3.0 gallons. *Terminal Tractors* are assumed to have the same tank volume as their diesel counterparts (5.71 gal) and *Hydro Power Units* are assumed to have fuel tank volumes of 5.0 gallons. Note that these assumptions apply to gasoline versions of the equipment only.

3.2.2. Diesel Fuel Tank Volumes

Fuel tank volumes for most diesel equipment were found from the regression line developed by EPA from John Deere equipment as described above in the section on gasoline fuel tank volumes. Fuel tanks for some equipment were taken from manufacturer supplied data and the reader is referred to Table I-16 for those details.

3.3. Methodology Used to Calculate Refueling Emission Factors

This section will present the methodology and data used to calculate refueling emission factors for gasoline and diesel equipment. The reader is referred to section 3.1, *Concepts of Refueling and Evaporative Emissions*, for a definition of refueling emissions.

3.3.1. Gasoline Refueling Emission Factors

Spillage -- Very little work has been done to quantify the amount of fuel spilled while refueling nonroad engines. The only known spillage values have been presented by Briggs & Stratton and OPEI for lawn and garden equipment (primarily standard walk behind lawnmowers). Briggs & Stratton has presented a value of 45 grams (approximately 1.5 oz.) per refueling and suggested that the value be reduced to 22.5 g/refueling as the user becomes familiar with the equipment.[44] OPEI reported in a study completed in September of 1991 that 17 grams of fuel were spilled during a typical refueling incident. All of these values are much higher than the spillage value which may be *backed out* of Mobile4 for on-highway vehicles which is roughly 3.6 g/refueling (0.31 g/gal x 11.5 gal/refuel).[45]

The discrepancy between the Mobile4 value and the OPEI and Briggs & Stratton value is most likely due to the fact that (1) many nonroad engines are refueled from fuel containers which are more difficult to use than gasoline pumps, (2) fuel containers do not have automatic shut off capability and (3) equipment fuel tanks are not as accessible. Therefore, the numbers provided by OPEI and Briggs & Stratton are probably closer to the true value for nonroad engines which are typically refueled from a portable, hand-held fuel container. When deriving the emission factors presented in this study, EPA has assumed that 17 g of fuel is spilled per refueling when a portable fuel container is used and, for nonroad equipment that is refueled from a gasoline pump, spillage is assumed to be 3.6 g/refueling. EPA chose the OPEI over the Briggs & Stratton value because it is based on substantially more data.

The method of refueling (pump or container) is discerned by equipment type and fuel tank size. Lawn and garden (except chippers/stump grinders), recreational, and light commercial equipment are assumed to be refueled from portable fuel containers. In addition, any other equipment with fuel tank volumes less than 6 gallons[46] [**] are assumed to be

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[**] The largest common consumer hand-held fuel container volume is 6 gallons.

refueled primarily from portable fuel containers regardless of category (except baggage tow tractors). All other equipment are assumed to be refueled from a fuel pump. The amount of fuel spilled per gallon of gasoline consumed may be calculated by:

$$Spillage_{portable\ container}\left[\frac{g}{gal}\right] = \frac{17.0\left[\frac{g}{refuel.}\right]}{Tank\ Vol.\left[\frac{gal}{refuel.}\right]}$$

or,

$$Spillage_{fuel\ pump}\left[\frac{g}{gal}\right] = \frac{3.6\left[\frac{g}{refuel.}\right]}{Tank\ Vol.\left[\frac{gal}{refuel.}\right]}$$

where *Tank Vol.* is the effective fuel tank volume. All refuelings are assumed to be *fill-ups* and thus, the spillage estimates are low.

Vapor Displacement -- Vapor displacement emission values were taken from on-highway data because no estimates for vapor displacement emissions from nonroad engines can be found in literature. However, the on-highway and nonroad displacement values should be similar since the gasoline composition for both is the same. EPA has implemented the model proposed by Rothman and Johnson of the EPA for on-highway vehicles to predict displacement emissions[47]:

$$Disp. = -5.909 - 0.0949 \times dT + 0.0884 \times Td + 0.485 \times RVP$$

$$\begin{aligned} where\text{:}\quad Disp. &= Displacement\left(\frac{g}{gal}\right) \\ dT &= Temp\ of\ Tank - Temp\ of\ Dispensed\ Fuel\ (^\circ F) \\ Td &= Temp\ of\ Dispensed\ Fuel\ (^\circ F) \\ RVP &= Reid\ Vapor\ Pressure \end{aligned}$$

Rothman and Johnson also recommend seasonal national average values for the model variables. EPA has matched those averages with equipment types for the particular season of the year in which the equipment is most likely to operate. Rothman and Johnson's summer and annual RVP values are not used in anticipation of the new RVP standards which will limit RVP to 10.5 during the summer of 1992. The annual average RVP was recalculated based on the new summer RVP and the current winter RVP as shown below.

$$\mathit{Annual\ RVP} = \frac{5 \times 10.5 + 7 \times 13.9}{12} = 12.5$$

The equipment tank temperature, dispensed fuel temperature (Td) and delta T (dT) values suggested by Rothman and Johnson are shown in the table below (with modifications) for equipment which are refueled from a gas pump.[48] Rothman and Johnson's values have been modified further to estimate displacement emissions from equipment refueled from a portable fuel container. Those values are also shown in the table.

Refueling Method	Season	Equip. Tank Temp.	Dispensed Temp. (Td)	dT (°F)	RVP	DISP (g/gal)
Fuel Pump	Annual Average	73.3	68.9	4.40	12.5	5.83
	Summer Average	85.0	76.2	8.80	10.5	5.08
	Winter Average	59.5	60.3	-0.80	13.9	6.09
Portable Container	Annual Average	73.3	73.3	0.00	12.5	6.63
	Summer Average	85.0	85.0	0.00	10.5	6.70
	Winter Average	59.5	59.5	0.00	13.9	6.09

The temperature differences between the equipment's fuel tank and the dispensed fuel (dT), as well as the actual dispensed fuel temperature (Td), are representative of fuel dispensed from underground storage tanks. It is unlikely that the temperature of fuel dispensed from a portable fuel container will match that of fuel dispensed from an underground storage tank. Rather, the fuel temperature from a portable container will most likely match that of the fuel in the equipment since both the container and equipment are exposed to the same ambient conditions. Therefore, the "pump dispensed" values suggested by Rothman and Johnson are used only for equipment refueled from gasoline fuel pumps. For equipment refueled from fuel containers, the values Td are assumed equal to the equipment tank temperature. Thus, dT is zero.

It can be correctly argued that the dispensed fuel temperature for many nonattainment areas will be dissimilar to those values presented above--especially the winter time values. While recognizing this deficiency, EPA is unable to incorporate *city-by-city* emission factors due to the immense size of that task. The best available national emission factors are used for all cities. A list of equipment and the associated displacement emission factors as well as total refueling emission factors is located in Table I-15.

To make the refueling emission factors compatible with the populations and usage rates used in the study, the refueling emission factor units were changed from grams per gallon to grams per horsepower hour (except some recreational equipment which are expressed in g/hr and marine vessels which are expressed in g/gal) by multiplying the original value by the brake specific fuel consumption (BSFC). To facilitate that change, assumptions regarding BSFC were necessary. BSFC data provided by SWRI and CARB were used to estimate BSFC's for equipment with average horsepower of 8 hp and less, 8 hp to 20 hp and above 20 hp. The values assumed are 0.219[49] [††], 0.15[50] [‡‡], or 0.0806[51] gal/hp-hr, respectively. After selecting the appropriate BSFC, refueling emission factors were easily transformed to units of grams per brake horsepower hour. For example, if the original spillage value is 49.78 g/gal (walk behind lawnmower, avg hp = 4.0) then,

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[††] Assume 95% side valve, 5% OHV using 4-4.5 hp engines. Assume 6.2 lb of gasoline per gallon.

[‡‡] Assume 90% side valve, 10% OHV using 11-12 hp engines. Assume 6.2 lb per gallon of gasoline.

$$49.78 \frac{g}{gal} \times 0.219 \frac{gal}{hp-hr} = 10.90 \frac{g}{hp-hr}$$

Refueling emission factors for all recreational equipment except snowmobiles are expressed in units of g/hr, instead of g/hp-hr. The conversions were made by multiplying the original value in g/hp-hr by the average horsepower and load factor supplied by EEA. For example, the conversion for minibikes is:

$$11.26 \frac{g}{hp-hr} \times 4\ hp \times 0.62 = 12.92 \frac{g}{hr}$$

3.3.2. Diesel Refueling Emission Factors

Refueling emissions from diesel fueled equipment are not as significant as those from gasoline fueled equipment because diesel fuel has a relatively high initial boiling temperature of 350 °F which impedes its evaporation. Gasoline, on the other hand, has initial boiling temperatures of 60 - 80 °F depending on the season of year (RVP) and, therefore, evaporates more readily.[52] As a result, very little work has been done to quantify diesel refueling emissions. Indeed, EPA is not aware of any studies of emissions from spilled diesel fuel. However, work has been done by F. Peter Hutchins of the EPA to quantify displacement emissions from diesel fuel.[53] Hutchins' work has shown the displacement emissions from diesel fuel to be 0.041 grams per gallon of fuel dispensed and fuel tank temperatures of approximately 80 °F. For the purposes of the present study, all diesel equipment are assumed to emit HC vapors at a rate of 0.041 grams per gallon of fuel dispensed. EPA is not aware of any other data pertaining to refueling or evaporative emissions from diesel fueled equipment and, therefore, other diesel refueling emission sources are not included in this study.

Just as was needed for the gasoline refueling emission factors, the diesel refueling emission factors were adjusted to be compatible with the populations and usage rates used in the study. The units were changed from grams per gallon to grams per horsepower hour (except some recreational equipment which are expressed in g/hr and marine vessels which are expressed in g/gal). To facilitate that change, assumptions regarding the brake specific fuel consumption (BSFC) were necessary. Recognizing that diesel equipment generally have lower BSFCs than gasoline equipment, the gasoline BSFC values were multiplied by 0.8 to estimate BSFCs for diesel equipment[54]. Therefore, the BSFCs assumed in this report for diesel equipment are 0.175, 0.12, and 0.065 gal/hp-hr, for engines under 8 hp, between 8 and 20 hp, and over 20 hp, respectively. Refueling emission factors for all recreational equipment except snowmobiles are expressed in units of g/hr, instead of g/hp-hr. The conversion was made by multiplying the original value in g/hp-hr by the average horsepower and load factor supplied by EEA.

3.4. Methodology Used to Calculate Evaporative Emission Factors

This section will present the methodology and data used to calculate evaporative emission factors for gasoline and diesel equipment. Evaporative emissions are composed of diurnal, hot soak, resting loss and running loss emissions and this section will present each individually.

3.4.1. Gasoline Evaporative Emission Factors

Diurnal -- The most comprehensive data available for diurnal emissions appears to be contained in two reports written by Charles T. Hare and Karl J. Springer of Southwest Research Institute.[55] [56] Both CARB and AP-42 refer to their work for diurnal emissions. In summary, Southwest developed diurnal emission factors of 2 g/gal/day[ll] and 4 g/gal/day for protected (shaded) and unprotected fuel tanks, respectively, during the in-use season. This report will assume the average of the two estimates, 3 g/gal/day, because of the difficulty in determining what percentage of each type of equipment has protected or unprotected fuel tanks. Diurnal emission factors, in units of grams per day of possible use, are calculated from the fuel tank volumes developed in section 3.2 of this appendix and are presented in Table I-15. *Vessels w/Outboard Engines* and *Sailboat Auxiliary Outboard Engines* are assumed to have no diurnal emissions because fuel tanks for those equipment types are not vented.[57]

[ll] g/gal/day means grams of HC emissions per gallon of tank volume (not necessarily gallon of fuel) per day

Hot Soak -- After reviewing SAE papers and SwRI reports regarding evaporative emissions and referring with several manufacturers, EPA found no appropriate values for hot soak emission factors for nonroad engines. Hot soak emission values for on-highway engines do exist, but they are not representative of nonroad engines due to the different size, design, packaging and carburetors that each employs. Therefore, this study does not account for hot soak emissions.

Resting Loss -- Resting loss emissions are not included in this study due to the lack of available data. However, to obtain a *feel* for the potential magnitude of this type of emission, one can consider the amount of fuel a plastic storage container is permitted to lose and still meet the standards devised by the American Society for Testing and Materials (ASTM). A nonmetallic fuel container passes the standards set by ASTM if it loses less than 1% of its mass over 30 days at a temperature of 75 °F. The test fuel used is a 70% isooctane, 30% toluene mixture (by volume). Assuming that the test fuel and regular gasoline behave the same, the standard indicates the fuel container could lose up to 28 grams of fuel per month.

Running Loss -- Just as for hot soak emissions, no data on the subject of running loss emissions for nonroad engines was found and on-highway values would not be representative. Therefore, running loss emissions are not accounted for in this study.

3.4.2. Diesel Evaporative Emission Factors

EPA is not aware of any diesel evaporative emission data and therefore, diesel evaporative emissions are not included in this study. On a qualitative basis, however, it can be said that evaporative emissions from diesel equipment should be much less than evaporative emissions from gasoline equipment because diesel fuel has a relatively high initial boiling temperature of 350 °F which impedes its evaporation. Gasoline, on the other hand, has initial boiling temperatures of 60 - 80 °F depending on the season of year (RVP) and, therefore, evaporates more readily.[58]

Chapter 4. Crankcase Emission Factors

Crankcase emission factors are presented in this section for gasoline and diesel nonroad equipment after a brief introduction of crankcase emissions.

Crankcase emissions are those exhaust gases which, upon leaving the combustion chamber, do not pass through the exhaust valve. Rather, the gases discharge into the crankcase via the clearance between the piston and cylinder wall. Eventually, these gases may escape from the crankcase to the atmosphere, hence, they are named *crankcase emissions* and the crankcase is said to be *open*. Some manufacturers produce engines which route crankcase vapors to the air intake system of the equipment. Those crankcases are called *closed* crankcases. Crankcase emissions, together with evaporative, refueling, and tailpipe emissions, constitute the total emissions from an engine.

All gasoline 4-stroke equipment are assumed to have open crankcases except Lawn and Garden Equipment (but not *Chippers/Stump Grinders*--they are assumed 100% open), *Vessels w/Inboard Engines* and *Vessels w/Sterndrive Engines*. Only 21% of Lawn and Garden Equipment are assumed open[59] [u] and 100% of *Vessels w/Inboard Engines* and *Vessels w/Sterndrive Engines* are assumed to have closed crankcases.

The rest of this chapter is separated into two sections. The first section introduces crankcase emission factors for 4-stroke gasoline fueled engines and the second introduces crankcase emission factors for 4-stroke diesel fueled engines. Crankcase emissions from 2-stroke engines do not exist due to the nature of 2-stroke engines. Thus, for equipment with both 2-stroke and 4-stroke varieties, the crankcase emission factor is applied only to the 4-stroke engines when calculating total emissions.

4.1. Gasoline Crankcase Emission Factors

This section will present crankcase emission factors for nonroad gasoline engines and describe the methodology for developing them. EPA is not aware of any significant nonroad crankcase emission data and has been forced to utilize data from on-highway engines. Even so, estimates for crankcase carbon monoxide (CO) or oxides of nitrogen (NO_x) could not be found. Therefore, those pollutants are not considered for gasoline nonroad crankcase emissions. The following paragraphs will present crankcase HC emission factors for gasoline nonroad engines.

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[u] Assume B & S engines represent 60% of market and are 99% closed and Tecumseh and others represent 40% of market and are 48% closed.

Probably the most widely accepted values for nonroad crankcase HC emissions are those found in AP-42.[60] AP-42 reports crankcase HC emissions for farm and construction equipment based on work performed by Southwest Research Institute (SwRI) in the early 1970's.[61] The SwRI work on crankcase HC emissions suggests that "crankcase hydrocarbon emissions are equivalent to about 20 percent of those in the exhaust . . ."[62] This generalization is based on work performed by Charles M. Heinen[63] and P. A. Bennett, et al[64] [***] for on-highway vehicles. However, when calculating crankcase emissions, Hare and Springer misinterpreted the Heinen report. Heinen actually proposed the value of 33% of exhaust emissions (20% of total HC emissions) which was estimated by Fred W. Bowditch of General Motors.[65] Heinen chose Bowditch's number as the best compromise of competing values supplied by CARB (31% of uncontrolled HC exhaust; 20% of total),[66] the Federal Government (49% of uncontrolled HC exhaust; 26% of total)[67] and Bowditch (see chart below). The origins of the values supplied by the Federal Government and CARB are unknown while the crankcase emission values put forth by Bowditch (33% of uncontrolled HC exhaust emissions and 20% of total emissions) appear to be educated estimates based on General Motors "quality audit data".

	CARB		**Federal**		**Bowditch**		**Bennett**	
Emis. Type	**% Tot**	**% Exh**	**% Tot**	**% Exh**	**% Tot**	**% Exh**	**% Tot**	**% Exh**
Crank.	20	31	26	49	20	33	40	70
Evap.	15	23	21	40	20	33	--	--
Exhaust	65	100	53	100	60	100	60	100

After updating AP-42 using Bowditch's number, the values for crankcase emissions for agricultural equipment are 42.2 g/hr and 47.2 g/hr for tractors and nontractors, respectively. These corrected AP-42 estimates closely agree with an EPA study of crankcase HC emissions from nine on-highway vehicles with disabled PCV systems and disconnected fresh air hoses on a gram/hour basis.[68] The EPA found that the nine vehicles studied emitted, on average, 1.92 grams of HC per mile (37.6 g/hr based on 3 bag FTP with average speed of 19.6 mph) over the first three bags of the FTP driving schedule with PCV and fresh air hose disconnected. This value, 37.6 g/hr, compares reasonably well with the updated AP-42 estimates of 42.24 and 47.2 g/hr for tractor and nontractor farm equipment, respectively, run over a steady state mode test. For purposes of estimating total emissions from 4-stroke gasoline nonroad engines, EPA accepts Bowditch's value (33% of untreated exhaust) for all gasoline engines with *open* crankcases. Four-stroke engines with closed crankcases and all 2-stroke engines are assumed to have no crankcase emissions.

[***] Bennett estimated crankcase emissions to be approximately 70% of exhaust emissions (40% of total HC emissions) based on testing five cars.

There may be concerns regarding the reliability of Bowditch's crankcase number (33% of uncontrolled HC exhaust) for use with today's nonroad engines. The relationship between on-highway crankcase emissions and nonroad crankcase emissions has never been documented for current year on-highway and nonroad engines. Differences in operating cycles, machining tolerances, fuel delivery systems, etc., of on-highway and nonroad engines compromise the ability to use existing on-highway engine exhaust and crankcase emissions to generate nonroad emission factors. For instance, technological advances in combustion design for on-highway vehicles may not have been applied to nonroad engines to date. In addition, those advances may decrease exhaust and/or crankcase emissions but perhaps disproportionally. Despite the legitimate concerns mentioned above, EPA believes that the Bowditch number remains the best available estimate for crankcase emissions because it has been corroborated by EPA in Report #460/3-84-011.[69] In addition, it is more conservative than Bennett's number which has not been corroborated by other sources.

4.2. Diesel Crankcase Emission Factors

This section will present the best available HC, CO, and NO_X emission factors for nonroad diesel engines and describe the methodology for developing them.

Data for crankcase emissions from diesel engines is limited. In fact, no studies which explicitly investigate crankcase emissions from nonroad diesel engines have been found.

However, studies have been found for on-highway crankcase emissions. The most recent and comprehensive paper has been published by Charles T. Hare and Thomas M. Baines.[70] Hare and Baines studied three engines of which two were approximately half way between overhauls and the other was relatively new. They found that hydrocarbon crankcase emissions represent approximately 0.3 to 4.0 percent of corresponding exhaust hydrocarbon emissions (0.006 to 0.017 g/kW-hr) when tested over the 13-mode test procedure. These values are consistent with earlier studies conducted by Chevalier[71] (approximate average value = 0.0395 g/kW-hr[†††]) of heavily worn diesel engines and Caterpillar (0.017 g/kW-hr).[72] The condition of the Caterpillar engine was not reported. For the purposes of EPA's nonroad study, diesel crankcase HC emissions will be assumed to be 2 percent (the mean of the range found by Hare and Baines) of untreated exhaust hydrocarbon emissions unless a *closed* crankcase is implemented.

CO and NO_X emissions from diesel crankcases have been reported by Hare and Baines, and Caterpillar. Hare and Baines reported CO and NO_X emission rates of 0.015 to 0.43 percent and 0.006 to 0.1 percent of exhaust emissions, respectively. Their numbers are corroborated by Caterpillar who reported CO and NO_X emission rates of 0.23 and 0.076 of exhaust emission rates. For the purposes of EPA's nonroad study, CO and NO_X crankcase emissions from diesel engines will be assumed to be 0.2 percent and 0.05 percent (the mean of the values reported by Hare and Baines) of exhaust emissions, respectively. In cases where the crankcase is closed, EPA assumes zero diesel crankcase emissions.

[†††] Assume BSFC of 0.5 lb/hp-hr.

Chapter 5. Benzene

Based on review of the limited available data for toxic emissions of benzene and 1,3-butadiene, EPA found it most appropriate in these cases to calculate emission rates as a weight percentage of the total hydrocarbon emissions. Benzene exhaust emissions are expressed as roughly 3 percent by weight of tailpipe exhaust hydrocarbons and crankcase hydrocarbons for both gasoline and diesel engines. Only four studies of benzene emissions were available for data applicable to nonroad configurations (i.e., noncatalyst).[73] Analysis of the data indicated that while there were large differences in the benzene emissions with power and driving cycle when expressed in milligrams per hour, milligram per horsepower hour, or milligrams per mile, the differences were far less when expressed as a percent of total exhaust hydrocarbon emissions, as presented in the SwRI report.[74] Refueling emissions, which consist of spillage and vapor displacement, were assumed to consist of 1.7% (weight) benzene which is the average summer and winter grade benzene content of in-use gasoline (diesels were assumed to have negligible refueling emissions).

Chapter 6. 1,3-Butadiene

EPA has also chosen to express 1,3-butadiene emissions as a weight percent of tailpipe exhaust hydrocarbons plus crankcase hydrocarbons. The respective percentages used in this study for nonroad diesel and gasoline engines are 1.6% and 1.3%.[75] Emissions of 1,3-butadiene were almost never measured in engine exhaust prior to the late 1980's, because the procedures for doing so are relatively new. Only one study was available with measurement from diesel engines, and one study with measurements from noncatalyst gasoline automobiles tested on unleaded gasoline. None of the studies found involved measurement from nonroad equipment and duty cycles. However, due to the lack of additional information, EPA did apply these emission rates to all categories.

Chapter 7. Nitrosamines

In addition to HC, CO and NO_x emissions, it has been documented that nitrosamines, which have been found to be carcinogenic in animals, are emitted from vented diesel crankcases.[76] While the contribution of motor vehicle emissions to the nitrosamine concentration is not known for certain, Thomas M. Baines of EPA reports[77] that three researchers (Gordon,[78] Shapley[79] and Pellizzari[80]) have identified nitrosamines near roadways and two of the three suspected automobiles as a source. Gordon reported nitrosamine concentrations as high as 1.1 micrograms per cubic meter in the Los Angeles basin. In his technical report, Baines proposes 109 cancer incidents per year if 1.5 million people are exposed to 1.1 micrograms per cubic meter for 2 hours per day. Undoubtedly, crankcase emissions of nitrosamines contribute to those cancer incidents[‡‡‡]. The reader is referred to EPA's Integrated Risk Information System (IRIS) for a more complete risk analysis and the technical report written by Thomas M. Baines for a more in depth analysis of nitrosamines from diesel crankcase emissions and car interiors.

[‡‡‡] However, because of uncertainties associated with the contribution of diesel crank cases to nitrosomine concentrations, inventories for nitrosomines were not developed.

TABLE I-01
EMISSION FACTORS USED FOR SIP INVENTORIES

a.) FARM EQUIPMENT

		HC				CO	NOx	PM	ALDEHYDES	SOx
		EXHAUST	CRANK	EVAP LB/YR	REFUELING					
GASOLINE TRACTORS	LB/1000GAL	125.00	41.25	23.20	12.60	3260.00	151.00	8.00	6.80	5.31
GASOLINE NONTRACTORS	LB/1000GAL	135.00	44.55	5.19	12.60	4100.00	98.50	6.86	4.10	5.28
DIESEL TRACTORS	LB/1000GAL	62.30	1.25	0.00	0.00	174.90	438.60	45.70	12.00	31.20
DIESEL NONTRACTORS	LB/1000GAL	71.10	1.42	0.00	0.00	170.90	435.00	51.30	10.20	5.28

b.) CONSTRUCTION EQUIPMENT

		HC				CO	NOx	PM	ALDEHYDES	SOx
		EXHAUST	CRANK	EVAP	REFUELING					
GASOLINE										
TRACKED TRACTORS	G/HP-HR	NA	NA	NA	NA	NA	NA	NA	NA	NA
TRACKED LOADERS	G/HP-HR	NA	NA	NA	NA	NA	NA	NA	NA	NA
MOTOR GRADERS	G/HP-HR	6.32	2.09	1.02	0.45	187.00	4.90	0.33	0.29	0.25
SCRAPERS	G/HP-HR	NA	NA	NA	NA	NA	NA	NA	NA	NA
OFF HIGHWAY TRUCKS	G/HP-HR	NA	NA	NA	NA	NA	NA	NA	NA	NA
WHEELED LOADERS	G/HP-HR	5.56	1.83	1.43	0.45	163.00	5.42	0.31	0.22	0.24
WHEELED TRACTORS	G/HP-HR	5.34	1.76	0.38	0.47	142.00	6.37	0.36	0.25	0.23
ROLLERS	G/HP-HR	9.25	3.05	2.59	0.47	202.00	5.28	0.39	0.26	0.28
WHEELED DOZERS	G/HP-HR	NA	NA	NA	NA	NA	NA	NA	NA	NA
MISCELLANEOUS	G/HP-HR	6.49	2.14	0.65	0.46	198.00	4.79	0.30	0.22	0.26
DIESEL										
TRACKED TRACTORS	G/HP-HR	0.90	0.02	0.00	0.00	2.40	10.30	0.69	0.17	0.85
TRACKED LOADERS	G/HP-HR	0.60	0.01	0.00	0.00	2.40	10.00	0.66	0.10	0.85
MOTOR GRADERS	G/HP-HR	1.10	0.02	0.00	0.00	1.90	9.60	0.63	0.12	0.87
SCRAPERS	G/HP-HR	0.50	0.01	0.00	0.00	2.50	8.70	0.79	0.28	0.90
OFF HIGHWAY TRUCKS	G/HP-HR	0.37	0.01	0.00	0.00	2.28	8.15	0.50	0.22	0.89
WHEELED LOADERS	G/HP-HR	0.60	0.01	0.00	0.00	2.40	10.30	0.81	0.20	0.86
WHEELED TRACTORS	G/HP-HR	1.76	0.04	0.00	0.00	7.34	11.91	1.27	0.28	0.85
ROLLERS	G/HP-HR	0.80	0.02	0.00	0.00	3.10	9.30	0.78	0.20	1.00
WHEELED DOZERS	G/HP-HR	0.37	0.01	0.00	0.00	2.28	8.15	0.41	0.16	0.89
MISCELLANEOUS	G/HP-HR	1.01	0.02	0.00	0.00	4.60	11.01	0.90	0.20	0.93

c.) INDUSTRIAL EQUIPMENT

		HC				CO	NOx	PM	ALDEHYDES	SOx
		EXHAUST	CRANK	EVAP	REFUELING					
GASOLINE	G/HP-HR	6.68	2.20	0.30	0.49	199.00	5.16	0.33	0.22	0.27
DIESEL	G/HP-HR	1.12	0.02	0.00	0.00	3.03	14.00	1.00	0.21	0.93

TABLE I-01 (cont.)

d.) LAWN & GARDEN EQUIPMENT

		HC				CO	NO_x	PM	ALDEHYDES	SO_x
		EXHAUST	CRANK	EVAP	REFUELING					
4-CYCLE	G/GAL	100.55	33.18	3.98	22.50	2093.28	11.91	1.87	3.14	2.37
2-CYCLE	G/GAL	922.11	0.00	11.48	22.50	2726.36	3.59	22.50	6.79	1.80

e.) OFF HIGHWAY MOTORCYCLE

		HC				CO	NO_x	PM	ALDEHYDES	SO_x
		EXHAUST	CRANK	EVAP G/MILE	REFUELING					
	G/MILE	17.70	1.84	0.36	0.45	34.20	0.15	0.15	0.07	0.03

f.) SNOWMOBILES

		HC				CO	NO_x	PM	ALDEHYDES	SO_x
		EXHAUST	CRANK	EVAP	REFUELING					
	G/YR	37800.00	0.00	1454.40	1981.00	58700.00	600.00	1670.00	552.00	51.00

g.) RECREATIONAL BOATS

		HC				CO	NO_x	PM	ALDEHYDES	SO_x
		EXHAUST	CRANK	EVAP	REFUELING G/GAL					
OUTBOARD	LB/1000GAL	1760.00	0.00		10.16	3470.00	7.80			6.80
INBORD GASOLINE	LB/1000GAL	137.00				1305.00	139.00	1.64	6.77	6.80
INBOARD DIESEL	LB/1000GAL	32.00	0.64	0.00	0.00	119.00	436.00	24.00	2.03	27.00

h.) COMMERCIAL MARINE VESSELS

		HC				CO	NO_x	PM	ALDEHYDES	SO_x
		EXHAUST	CRANK	EVAP	REFUELING					
COASTAL	LB/1000GAL	24.00	0.48	0.00	0.00	61.00	550.00	33.00		27.00
GREAT LAKES	LB/1000GAL	59.00	1.18	0.00	0.00	110.00	260.00	17.00		27.00
RIVER	LB/1000GAL	50.00	1.00	0.00	0.00	100.00	280.00	17.00		27.00
STEAMSHIPS HOTELLING	LB/1000GAL	3.20		0.00	0.00	NA	36.40	10.00		318.00
STEAMSHIPS CRUISE	LB/1000GAL	0.70		0.00	0.00	3.45	55.80	20.00		318.00
<6' DRAFT	LB/1000GAL	51.10	1.02	0.00	0.00	47.30	389.30	17.00		27.00
6'-12' DRAFT	LB/1000GAL	44.50	0.89	0.00	0.00	99.70	338.60	17.00		27.00
12'-18'DRAFT	LB/1000GAL	16.80	0.34	0.00	0.00	62.20	167.20	17.00		27.00
>18' DRAFT	LB/1000GAL	24.00	0.48	0.00	0.00	61.00	550.00	33.00		27.00
STEAMSHIP CRUISE	LB/1000GAL	0.70		0.00	0.00	3.50	55.80	20.00		318.00

Table I-02. Emission Factors for Inventories A and B

a.) DIESEL EQUIPMENT (grams/hp-hr)

			HC						Inv. A	Inv. B		
Class	Equipment Types		EXHAUST	CRANK	EVAP	REFUELING	CO	NOx	PM	PM	ALDEHYDE	SOX
1	Trimmers/Edgers/Brush Cutters		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1	Lawn Mowers		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1	Leaf Blowers/Vacuums		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1	Rear Engine Riding Mowers		1.20	0.02	NA	0.005	5.00	8.00	1.00	0.65	0.06	0.93
1	Front Mowers		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1	Chainsaws <4 HP		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1	Shredders <5 HP		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1	Tillers <5 HP		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1	Lawn & Garden Tractors		1.20	0.02	NA	0.005	5.00	8.00	1.00	0.65	0.06	0.93
1	Wood Splitters		1.20	0.02	NA	0.003	5.00	8.00	1.00	0.65	0.06	0.93
1	Snowblowers		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1	Chippers/Stump Grinders		1.20	0.02	NA	0.003	5.00	8.00	1.00	0.65	0.06	0.93
1	Commercial Turf Equipment		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1	Other Lawn & Garden Equipment		1.20	0.02	NA	0.005	5.00	8.00	1.00	0.65	0.06	0.93
3	All Terrain Vehicles (ATVs)	*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3	Minibikes	*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3	Off-Road Motorcycles	*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3	Golf Carts	*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3	Snowmobiles		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3	Specialty Vehicles Carts	*	1.20	0.02	NA	0.350	5.00	8.00	1.00	0.65	0.06	0.93
5	Generator Sets <50 HP		1.20	0.02	NA	0.003	5.00	8.00	1.00	0.65	0.06	0.93
5	Pumps <50 HP		1.20	0.02	NA	0.003	5.00	8.00	1.00	0.65	0.06	0.93
5	Air Compressors <50 HP		1.20	0.02	NA	0.003	5.00	8.00	1.00	0.65	0.06	0.93
5	Gas Compressors <50 HP		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
5	Welders <50 HP		1.20	0.02	NA	0.003	5.00	8.00	1.00	0.65	0.06	0.93
5	Pressure Washers <50 HP		1.20	0.02	NA	0.003	5.00	8.00	1.00	0.65	0.06	0.93
6	Aerial Lifts	a	1.57	0.03	NA	0.003	6.06	14.00	1.60	1.03	0.21	0.93
6	Forklifts	a	1.57	0.03	NA	0.003	6.06	14.00	1.60	1.03	0.21	0.93
6	Sweepers/Scrubbers	a	1.57	0.03	NA	0.003	6.06	14.00	1.60	1.03	0.21	0.93
6	Other General Industrial Equipment	a	1.57	0.03	NA	0.003	6.06	14.00	1.60	1.03	0.21	0.93
6	Other Material Handling Equipment	a	1.57	0.03	NA	0.003	6.06	14.00	1.60	1.03	0.21	0.93
7	Asphalt Pavers		0.80	0.01	NA	0.003	3.20	10.30	0.90	0.80	0.20	0.93
7	Tampers/Rammers		0.00	0.00	NA	NA	0.00	0.00	0.00	0.00	0.00	0.00
7	Plate Compactors		0.80	0.02	NA	0.007	3.10	9.30	0.90	0.80	0.20	0.93
7	Concrete Pavers		1.10	0.02	NA	0.003	4.57	10.02	0.90	0.80	0.20	0.93
7	Rollers		0.80	0.02	NA	0.003	3.10	9.30	0.78	0.53	0.20	1.00
7	Scrapers	a	0.70	0.01	NA	0.003	5.00	8.70	1.26	0.86	0.26	0.90
7	Paving Equipment		1.01	0.02	NA	0.003	4.80	11.01	0.90	0.80	0.20	0.93
7	Surfacing Equipment		0.00	0.00	NA	NA	0.00	0.00	0.00	0.00	0.00	0.00
7	Signal Boards		1.20	0.02	NA	0.007	5.00	8.00	1.00	0.65	0.20	0.93
7	Trenchers	a	1.54	0.03	NA	0.003	9.14	10.02	1.44	0.95	0.20	0.93
7	Bore/Drill Rigs	a	1.41	0.03	NA	0.003	9.20	11.01	1.44	0.95	0.20	0.93
7	Excavators	a	0.70	0.01	NA	0.003	5.20	10.75	1.44	0.95	0.20	0.93
7	Concrete/Industrial Saws	a	1.41	0.03	NA	0.003	9.20	11.01	1.44	0.95	0.20	0.93
7	Cement and Mortar Mixers		1.01	0.02	NA	0.006	4.80	11.01	0.90	0.80	0.20	0.93
7	Cranes	a	1.26	0.03	NA	0.003	4.20	10.30	1.44	0.95	0.20	0.93
7	Graders	a	1.54	0.03	NA	0.003	3.80	9.60	1.00	0.73	0.12	0.87
7	Off-Highway Trucks	a	0.84	0.02	NA	0.003	2.80	9.60	0.80	0.63	0.22	0.89
7	Crushing/Proc. Equipment	a	1.41	0.03	NA	0.003	9.20	11.01	1.44	0.95	0.20	0.93
7	Rough Terrain Forklifts	a	1.66	0.03	NA	0.003	10.00	8.00	1.60	1.03	0.20	0.93
7	Rubber Tired Loaders	a	0.84	0.02	NA	0.003	4.80	10.30	1.29	0.88	0.20	0.86
7	Rubber Tired Dozers	a	0.84	0.02	NA	0.003	2.80	9.60	0.66	0.56	0.16	0.93
7	Tractors/Loaders/Backhoes	a	1.40	0.03	NA	0.003	6.80	10.10	1.05	0.76	0.10	0.85
7	Crawler Tractors	a	1.26	0.03	NA	0.003	4.80	10.30	1.11	0.79	0.17	0.85
7	Skid Steer Loaders	a	2.10	0.04	NA	0.003	9.00	9.60	1.44	0.95	0.20	0.93
7	Off-Highway Tractors	a	2.46	0.05	NA	0.003	14.66	11.91	2.03	1.25	0.28	0.93
7	Dumpers/Tenders	a	0.84	0.02	NA	0.003	2.80	9.60	1.44	0.95	0.20	0.89
7	Other Construction Equipment	a	1.41	0.03	NA	0.003	9.20	11.01	1.44	0.95	0.20	0.93
8	2-Wheel Tractors		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
8	Agricultural Tractors	a	2.23	0.04	NA	0.003	8.94	11.21	2.05	1.26	0.34	0.87
8	Agricultural Mowers		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
8	Combines	a	1.26	0.03	NA	0.003	4.20	11.50	2.42	1.44	0.30	0.92
8	Sprayers		2.23	0.04	NA	0.003	3.78	7.78	1.51	0.90	0.30	0.92
8	Balers		2.23	0.04	NA	0.003	3.78	7.78	1.51	0.90	0.30	0.92
8	Irrigation Sets		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
8	Tillers >5 HP		1.20	0.02	NA	0.007	5.00	8.00	1.00	0.65	0.06	0.92
8	Swathers		0.90	0.02	NA	0.003	2.10	11.50	1.51	0.90	0.30	0.92
8	Hydro Power Units		2.23	0.04	NA	0.003	3.78	7.78	1.51	0.90	0.30	0.92
8	Other Agricultural Equipment		1.82	0.04	NA	0.003	4.37	11.12	1.51	0.90	0.30	0.92
9	Chainsaws >4 HP		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
9	Shredders >5 HP		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
9	Skidders	a	0.84	0.02	NA	0.003	5.20	11.30	1.44	0.95	0.20	0.93
9	Fellers/Bunchers	a	0.84	0.02	NA	0.003	5.20	11.30	1.44	0.95	0.20	0.93
2	Aircraft Support Equipment	a	1.57	0.03	NA	0.003	6.06	14.00	1.60	1.03	0.06	0.93
2	Terminal Tractors	a	1.57	0.03	NA	0.003	6.06	14.00	1.60	1.03	0.06	0.93
4	Vessels w/Inboard Engines	**	24.39	NA	NA	0.040	37.01	172.49	10.89	10.89	0.92	12.20
4	Vessels w/Outboard Engines	**	24.39	0.49	NA	0.000	37.01	172.49	10.89	10.89	0.92	12.20
4	Vessels w/Sterndrive Engines	**	24.39	NA	NA	0.000	37.01	172.49	10.89	10.89	0.92	12.20
4	Sailboat Auxiliary Inboard Engines	**	122.45	NA	NA	0.040	217.72	163.29	10.89	10.89	0.92	12.20
4	Sailboat Auxiliary Outboard Engines	**	122.45	2.45	NA	0.040	217.72	163.29	10.89	10.89	0.92	12.20

* g/hr

** g/gallon

a = Exhaust HC, CO, and PM adjusted for transient speed and/or transient load operation

NA = Not applicable

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Table I-02. (cont.)

b.) GASOLINE 4-STROKE EQUIPMENT (grams/hp-hr)
Not Adjusted for In-Use Effects

Class	Equipment Types		EXHAUST	HC CRANK	EVAP g/day	REFUELING	CO	NOx	PM	ALDEHYDE	SOX
1	Trimmers/Edgers/Brush Cutters		24.18	7.98	0.54	21.98	393.34	2.02	0.41	0.53	0.37
1	Lawn Mowers		37.70	12.44	1.16	8.60	430.00	2.02	0.74	0.53	0.37
1	Leaf Blowers/Vacuums		19.40	6.40	0.61	6.61	380.30	2.03	0.29	0.53	0.37
1	Rear Engine Riding Mowers		9.30	3.07	3.30	3.21	353.00	2.03	0.05	0.24	0.37
1	Front Mowers		9.30	3.07	18.60	1.30	353.00	2.03	0.05	0.24	0.37
1	Chainsaws <4 HP		NA	NA	NA	NA	NA	NA	NA	NA	NA
1	Shredders <5 HP		37.70	12.44	1.75	7.66	430.00	2.02	0.74	0.53	0.37
1	Tillers <5 HP		37.70	12.44	1.38	9.39	430.00	2.02	0.74	0.53	0.37
1	Lawn & Garden Tractors		9.40	3.10	7.13	1.84	354.00	2.11	0.10	0.24	0.37
1	Wood Splitters		37.70	12.44	1.16	8.60	430.00	2.02	0.74	0.53	0.37
1	Snowblowers		37.70	12.44	2.50	5.82	430.00	2.02	0.74	0.53	0.37
1	Chippers/Stump Grinders		37.70	12.44	94.86	0.42	430.00	2.02	0.05	0.53	0.37
1	Commercial Turf Equipment		9.40	3.10	15.50	1.38	354.00	2.11	0.10	0.24	0.37
1	Other Lawn & Garden Equipment		37.70	12.44	1.16	8.60	430.00	2.02	0.05	0.53	0.37
3	All Terrain Vehicles (ATVs)	*	100.00	33.00	6.00	31.15	975.00	9.00	1.15	1.18	0.55
3	Minibikes	*	100.00	33.00	1.50	21.68	975.00	9.00	1.15	1.18	0.55
3	Off-Road Motorcycles	*	100.00	33.00	6.00	30.92	975.00	9.00	1.15	1.18	0.55
3	Golf Carts	*	100.00	33.00	18.00	5.44	975.00	9.00	1.15	1.18	0.55
3	Snowmobiles		NA	NA	NA	NA	NA	NA	NA	NA	NA
3	Specialty Vehicles Carts	*	100.00	33.00	18.00	7.04	975.00	9.00	1.15	1.18	0.55
5	Generator Sets <50 HP		9.50	3.14	3.06	3.43	353.00	2.03	0.06	0.22	0.27
5	Pumps <50 HP		9.50	3.14	2.25	6.33	353.00	2.03	0.06	0.22	0.27
5	Air Compressors <50 HP		9.50	3.14	3.38	3.20	353.00	2.03	0.06	0.22	0.27
5	Gas Compressors <50 HP		NA	NA	NA	NA	NA	NA	NA	NA	NA
5	Welders <50 HP		9.50	3.14	9.75	1.72	353.00	2.03	0.06	0.22	0.27
5	Pressure Washers <50 HP		9.50	3.14	2.25	6.33	353.00	2.03	0.06	0.22	0.27
6	Aerial Lifts		6.68	2.20	55.06	0.49	199.00	5.16	0.06	0.22	0.27
6	Forklifts		6.68	2.20	54.00	0.49	199.00	5.16	0.06	0.22	0.27
6	Sweepers/Scrubbers		6.68	2.20	59.67	0.48	199.00	5.16	0.06	0.22	0.27
6	Other General Industrial Equipment		6.68	2.20	29.07	0.93	199.00	5.16	0.06	0.22	0.27
6	Other Material Handling Equipment		6.68	2.20	78.03	0.48	199.00	5.16	0.06	0.22	0.27
7	Asphalt Pavers		6.49	2.14	47.43	0.45	198.00	4.79	0.06	0.22	0.25
7	Tampers/Rammers		6.49	2.14	2.81	5.34	198.00	4.79	0.06	0.22	0.25
7	Plate Compactors		6.49	2.14	2.81	5.34	198.00	4.79	0.06	0.22	0.25
7	Concrete Pavers		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Rollers		9.25	3.05	9.00	1.61	202.00	5.28	0.06	0.26	0.28
7	Scrapers		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Paving Equipment		6.49	2.14	3.00	5.02	198.00	4.79	0.06	0.22	0.25
7	Surfacing Equipment		6.49	2.14	3.00	4.84	198.00	4.79	0.06	0.22	0.25
7	Signal Boards		6.49	2.14	3.06	4.94	198.00	4.79	0.06	0.22	0.25
7	Trenchers		6.49	2.14	7.69	0.94	198.00	4.79	0.06	0.22	0.25
7	Bore/Drill Rigs		6.49	2.14	82.62	0.42	198.00	4.79	0.06	0.22	0.25
7	Excavators		6.49	2.14	122.40	0.42	198.00	4.79	0.06	0.22	0.25
7	Concrete/Industrial Saws		6.49	2.14	4.13	2.74	198.00	4.79	0.06	0.22	0.25
7	Cement and Mortar Mixers		6.49	2.14	3.75	4.09	198.00	4.79	0.06	0.22	0.25
7	Cranes		6.49	2.14	84.15	0.42	198.00	4.79	0.06	0.22	0.25
7	Graders		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Off-Highway Trucks		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Crushing/Proc. Equipment		6.49	2.14	91.80	0.42	198.00	4.79	0.06	0.22	0.25
7	Rough Terrain Forklifts		6.49	2.14	134.64	0.42	198.00	4.79	0.06	0.22	0.25
7	Rubber Tired Loaders		5.56	1.83	102.51	0.42	163.00	5.42	0.06	0.22	0.24
7	Rubber Tired Dozers		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Tractors/Loaders/Backhoes		6.49	2.14	96.39	0.42	198.00	4.79	0.06	0.22	0.25
7	Crawler Tractors		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Skid Steer Loaders		6.49	2.14	25.01	0.44	198.00	4.79	0.06	0.22	0.25
7	Off-Highway Tractors		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Dumpers/Tenders		6.49	2.14	9.00	1.74	198.00	4.79	0.06	0.22	0.25
7	Other Construction Equipment		6.49	2.14	229.50	0.41	198.00	4.79	0.06	0.22	0.25
8	2-Wheel Tractors		5.49	1.81	7.13	2.69	143.00	6.62	0.06	0.30	0.23
8	Agricultural Tractors		5.49	1.81	133.11	0.42	143.00	6.62	0.06	0.30	0.23
8	Agricultural Mowers		7.18	2.37	8.01	1.84	218.00	5.24	0.06	0.22	0.28
8	Combines		7.18	2.37	200.43	0.41	218.00	5.24	0.06	0.22	0.28
8	Sprayers		7.18	2.37	4.50	1.39	218.00	5.24	0.06	0.22	0.28
8	Balers		NA	NA	NA	NA	NA	NA	NA	NA	NA
			NA	NA	NA	NA	NA	NA	NA	NA	NA
8	Tillers >5 HP		37.70	12.44	3.63	4.38	430.00	2.02	0.74	0.22	0.37
8	Swathers		7.18	2.37	162.18	0.42	218.00	5.24	0.06	0.22	0.28
8	Hydro Power Units		7.18	2.37	15.00	1.40	218.00	5.24	0.06	0.22	0.28
8	Other Agricultural Equipment		7.18	2.37	84.15	0.42	218.00	5.24	0.06	0.22	0.28
9	Chainsaws >4 HP		NA	NA	NA	NA	NA	NA	NA	NA	NA
9	Shredders >5 HP		9.30	3.07	3.00	5.02	353.00	2.02	0.05	0.24	0.37
9	Skidders		NA	NA	NA	NA	NA	NA	NA	NA	NA
9	Fellers/Bunchers		NA	NA	NA	NA	NA	NA	NA	NA	NA
2	Aircraft Support Equipment		6.68	2.20	73.44	0.48	199.00	5.16	0.06	0.22	0.27
2	Terminal Tractors		6.68	2.20	17.13	0.52	199.00	5.16	0.06	0.22	0.27
4	Vessels w/Inboard Engines	**	72.46	NA	280.10	5.13	1214.03	45.79	0.74	3.07	2.90
4	Vessels w/Outboard Engines	**	87.71	28.94	NA	8.75	1421.95	66.58	0.74	3.07	2.90
4	Vessels w/Sterndrive Engines	**	72.46	NA	63.00	5.26	1214.03	45.79	0.74	3.07	2.90
4	Sailboat Auxiliary Inboard Engines	**	72.46	NA	18.00	8.75	1214.03	45.79	0.74	3.07	2.90
4	Sailboat Auxiliary Outboard Engines	**	87.71	28.94	NA	8.75	1421.95	66.58	0.74	3.07	2.90

* g/hr
** g/gallon
NA = Not applicable

Table I-02. (cont.)

c.) GASOLINE 4-STROKE EQUIPMENT - IN-USE ADJUSTED (grams/hp-hr)
Adjusted for In-Use Effects.

Class	Equipment Types		EXHAUST	HC CRANK	EVAP	REFUELING	CO	NOx	PM	ALDEHYDE	SOX
					g/day	g/hp-hr					
1	Trimmers/Edgers/Brush Cutters	b	50.78	7.98	0.54	21.98	747.35	0.81	1.48	0.53	0.37
1	Lawn Mowers	b	79.17	12.44	1.16	8.60	817.00	0.81	2.66	0.53	0.37
1	Leaf Blowers/Vacuums	b	40.74	6.40	0.61	6.61	722.57	0.81	1.04	0.53	0.37
1	Rear Engine Riding Mowers	b	19.53	3.07	3.30	3.21	670.70	0.81	0.18	0.24	0.37
1	Front Mowers	b	19.53	3.07	18.60	1.30	670.70	0.81	0.18	0.24	0.37
1	Chainsaws <4 HP		NA	NA	NA	NA	NA	NA	NA	NA	NA
1	Shredders <5 HP	b	79.17	12.44	1.75	7.68	817.00	0.81	2.66	0.53	0.37
1	Tillers <5 HP	b	79.17	12.44	1.38	9.39	817.00	0.81	2.68	0.53	0.37
1	Lawn & Garden Tractors	b	19.74	3.10	7.13	1.84	672.60	0.84	0.36	0.24	0.37
1	Wood Splitters	b	79.17	12.44	1.16	8.60	817.00	0.81	2.68	0.53	0.37
1	Snowblowers	b	79.17	12.44	2.50	5.62	817.00	0.81	2.66	0.53	0.37
1	Chippers/Stump Grinders	c	56.55	12.44	94.88	0.42	559.00	2.02	0.05	0.53	0.37
1	Commercial Turf Equipment	b	19.74	3.10	15.50	1.38	672.60	0.84	0.36	0.24	0.37
1	Other Lawn & Garden Equipment	b	79.17	12.44	1.16	8.60	817.00	0.81	0.18	0.53	0.37
3	All Terrain Vehicles (ATVs)	*, b	210.00	33.00	6.00	31.15	1852.50	3.60	4.14	1.18	0.55
3	Minibikes	*, b	210.00	33.00	1.50	21.68	1852.50	3.60	4.14	1.18	0.55
3	Off-Road Motorcycles	*, c	150.00	33.00	6.00	30.92	1267.50	9.00	1.15	1.18	0.55
3	Golf Carts	*, b	210.00	33.00	18.00	5.44	1852.50	3.60	4.14	1.18	0.55
3	Snowmobiles		NA	NA	NA	NA	NA	NA	NA	NA	NA
3	Specialty Vehicles Carts	*, b	210.00	33.00	18.00	7.04	1852.50	3.60	4.14	1.18	0.55
5	Generator Sets <50 HP	b	19.95	3.14	3.06	3.43	670.70	0.81	0.22	0.22	0.27
5	Pumps <50 HP	b	19.95	3.14	2.25	6.33	670.70	0.81	0.22	0.22	0.27
5	Air Compressors <50 HP	b	19.95	3.14	3.38	3.20	670.70	0.81	0.22	0.22	0.27
5	Gas Compressors <50 HP	c	NA	NA	NA	NA	NA	NA	NA	NA	NA
5	Welders <50 HP	b	19.95	3.14	9.75	1.72	670.70	0.81	0.22	0.22	0.27
5	Pressure Washers <50 HP	b	19.95	3.14	2.25	6.33	670.70	0.81	0.22	0.22	0.27
6	Aerial Lifts	c	10.02	2.20	55.06	0.49	258.70	5.16	0.06	0.22	0.27
6	Forklifts	c	10.02	2.20	54.00	0.49	258.70	5.16	0.06	0.22	0.27
6	Sweepers/Scrubbers	c	10.02	2.20	59.67	0.48	258.70	5.16	0.06	0.22	0.27
6	Other General Industrial Equipment	c	10.02	2.20	29.07	0.93	258.70	5.16	0.06	0.22	0.27
6	Other Material Handling Equipment	c	10.02	2.20	78.03	0.48	258.70	5.16	0.06	0.22	0.27
7	Asphalt Pavers	c	9.74	2.14	47.43	0.45	257.40	4.79	0.06	0.22	0.25
7	Tampers/Rammers	b	13.63	2.14	2.81	5.34	376.20	1.92	0.22	0.22	0.25
7	Plate Compactors	b	13.63	2.14	2.81	5.34	376.20	1.92	0.22	0.22	0.25
7	Concrete Pavers		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Rollers	b	19.43	3.06	9.00	1.61	383.80	2.11	0.22	0.26	0.26
7	Scrapers		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Paving Equipment	b	13.63	2.14	3.00	5.02	376.20	1.92	0.22	0.22	0.25
7	Surfacing Equipment	b	13.63	2.14	3.00	4.84	376.20	1.92	0.22	0.22	0.25
7	Signal Boards	b	13.63	2.14	3.06	4.94	376.20	1.92	0.22	0.22	0.25
7	Trenchers	c	9.74	2.14	7.69	0.94	257.40	4.79	0.06	0.22	0.25
7	Bore/Drill Rigs	c	9.74	2.14	82.62	0.42	257.40	4.79	0.06	0.22	0.25
7	Excavators	c	9.74	2.14	122.40	0.42	257.40	4.79	0.06	0.22	0.25
7	Concrete/Industrial Saws	b	13.63	2.14	4.13	2.74	376.20	1.92	0.22	0.22	0.25
7	Cement and Mortar Mixers	b	13.63	2.14	3.75	4.09	376.20	1.92	0.22	0.22	0.25
7	Cranes	c	9.74	2.14	84.16	0.42	257.40	4.79	0.06	0.22	0.25
7	Graders		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Off-Highway Trucks		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Crushing/Proc. Equipment	c	9.74	2.14	91.80	0.42	257.40	4.79	0.06	0.22	0.25
7	Rough Terrain Forklifts	c	9.74	2.14	134.64	0.42	257.40	4.79	0.06	0.22	0.25
7	Rubber Tired Loaders	c	8.34	1.83	102.51	0.42	211.90	5.42	0.06	0.22	0.24
7	Rubber Tired Dozers		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Tractors/Loaders/Backhoes	c	9.74	2.14	96.39	0.42	257.40	4.79	0.06	0.22	0.25
7	Crawler Tractors		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Skid Steer Loaders	c	9.74	2.14	26.01	0.44	257.40	4.79	0.06	0.22	0.25
7	Off-Highway Tractors		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Dumpers/Tenders	b	13.63	2.14	9.00	1.74	376.20	1.92	0.22	0.22	0.25
7	Other Construction Equipment	c	9.74	2.14	229.80	0.41	257.40	4.79	0.06	0.22	0.25
8	2-Wheel Tractors	b	11.53	1.81	7.13	2.69	271.70	2.65	0.22	0.30	0.23
8	Agricultural Tractors	c	8.24	1.81	133.11	0.42	185.90	6.62	0.06	0.30	0.23
8	Agricultural Mowers	b	15.06	2.37	8.01	1.84	414.20	2.10	0.22	0.22	0.28
8	Combines	c	10.77	2.37	200.43	0.41	283.40	5.24	0.06	0.22	0.28
8	Sprayers	c	10.77	2.37	4.50	1.39	283.40	5.24	0.06	0.22	0.28
8	Balers		NA	NA	NA	NA	NA	NA	NA	NA	NA
			NA	NA	NA	NA	NA	NA	NA	NA	NA
8	Tillers >5 HP	b	79.17	12.44	3.63	4.38	817.00	0.81	2.66	0.22	0.37
8	Swathers	c	10.77	2.37	162.18	0.42	283.40	5.24	0.06	0.22	0.28
8	Hydro Power Units	b	15.06	2.37	15.00	1.40	414.20	2.10	0.22	0.22	0.28
8	Other Agricultural Equipment	c	10.77	2.37	84.15	0.42	283.40	5.24	0.06	0.22	0.28
9	Chainsaws >4 HP		NA	NA	NA	NA	NA	NA	NA	NA	NA
9	Shredders >5 HP	b	19.53	3.07	3.00	5.02	670.70	0.81	0.18	0.24	0.37
9	Skidders		NA	NA	NA	NA	NA	NA	NA	NA	NA
9	Fellers/Bunchers		NA	NA	NA	NA	NA	NA	NA	NA	NA
2	Aircraft Support Equipment	c	[illegible]	2.20	73.44	0.48	258.70	5.16	0.06	0.22	0.27
2	Terminal Tractors	c	[illegible]	[illegible]	17.13	0.52	258.70	5.16	0.06	0.22	0.27
4	Vessels w/Inboard Engines	**, c	[illegible]	[illegible]	[illegible]	5.13	1578.24	45.79	0.74	3.07	2.90
4	Vessels w/Outboard Engines	**, c	131.57	28.94	NA	8.75	1848.54	66.58	0.74	3.07	2.90
4	Vessels w/Sterndrive Engines	**, c	108.69	NA	63.00	5.26	1578.24	45.79	0.74	3.07	2.90
4	Sailboat Auxiliary Inboard Engines	**, c	108.69	NA	18.00	8.75	1578.24	45.79	0.74	3.07	2.90
4	Sailboat Auxiliary Outboard Engines	**, c	131.57	28.94	NA	8.75	1848.54	66.58	0.74	3.07	2.90

* g/hr
** g/gallon
b = adjusted for in-use effects using small utility engine data
c = adjusted for in-use effects using heavy duty engine data
NA = Not applicable

Table I-02. (cont.)

d.) GASOLINE 2-STROKE EQUIPMENT (grams/hp-hr)
Not Adjusted for In-Use Effects

Class	Equipment Types		HC EXHAUST	CRANK	EVAP g/day	REFUELING	CO	NOx	PM	ALDEHYDE	SOX
1	Trimmers/Edgers/Brush Cutters		224.56	NA	0.54	21.96	726.22	0.91	3.69	2.04	0.54
1	Lawn Mowers		206.00	NA	1.16	8.60	486.00	0.29	7.70	2.04	0.54
1	Leaf Blowers/Vacuums		215.29	NA	0.61	6.61	716.81	0.96	3.60	2.04	0.54
1	Rear Engine Riding Mowers		NA	NA	NA	NA	NA	NA	NA	NA	NA
1	Front Mowers		NA	NA	NA	NA	NA	NA	NA	NA	NA
1	Chainsaws <4 HP		296.00	NA	0.32	35.93	699.00	0.96	3.60	1.60	0.54
1	Shredders <5 HP		206.00	NA	1.75	7.68	486.00	0.29	7.70	2.04	0.54
1	Tillers <5 HP		206.00	NA	1.36	9.39	486.00	0.29	7.70	2.04	0.54
1	Lawn & Garden Tractors		NA	NA	NA	NA	NA	NA	NA	NA	NA
1	Wood Splitters		NA	NA	NA	NA	NA	NA	NA	NA	NA
1	Snowblowers		206.00	NA	2.50	5.82	486.00	0.29	7.70	2.04	0.54
1	Chippers/Stump Grinders		NA	NA	NA	NA	NA	NA	NA	NA	NA
1	Commercial Turf Equipment		206.00	NA	15.50	1.38	486.00	0.29	7.70	2.04	0.54
1	Other Lawn & Garden Equipment		206.00	NA	1.16	8.60	486.00	0.29	7.70	2.04	0.54
3	All Terrain Vehicles (ATVs)	*	600.00	NA	6.00	31.15	600.00	1.50	8.20	2.75	0.95
3	Minibikes	*	NA	NA	NA	21.66	NA	NA	NA	NA	NA
3	Off-Road Motorcycles	*	600.00	NA	6.00	30.92	600.00	1.50	8.20	2.75	0.95
3	Golf Carts	*	600.00	NA	18.00	5.44	600.00	1.50	8.20	2.75	0.95
3	Snowmobiles		109.00	NA	24.24	0.67	169.00	1.70	4.80	0.40	0.15
3	Specialty Vehicles Carts	*	600.00	NA	18.00	7.04	600.00	1.50	8.20	2.75	0.95
5	Generator Sets <50 HP		206.00	NA	3.06	3.43	486.00	0.29	7.70	2.04	0.27
5	Pumps <50 HP	**	4.28	1.41	2.25	6.33	113.00	7.04	0.06	0.22	0.00
5	Air Compressors <50 HP		NA	NA	NA	NA	NA	NA	NA	NA	NA
5	Gas Compressors <50 HP	**	4.28	1.41	NA	NA	113.00	7.04	0.06	0.22	0.00
5	Welders <50 HP		NA	NA	NA	NA	NA	NA	NA	NA	NA
5	Pressure Washers <50 HP		NA	NA	NA	NA	NA	NA	NA	NA	NA
6	Aerial Lifts	**	3.00	0.99	56.06	0.49	63.70	17.90	0.06	0.22	0.00
6	Forklifts	**	3.00	0.99	54.00	0.49	63.70	17.90	0.06	0.22	0.00
6	Sweepers/Scrubbers	**	3.00	0.99	59.67	0.48	63.70	17.90	0.06	0.22	0.00
6	Other General Industrial Equipment		206.00	NA	20.07	0.93	486.00	0.29	7.70	2.04	0.27
6	Other Material Handling Equipment		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Asphalt Pavers		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Tampers/Rammers		206.00	NA	2.81	5.34	486.00	0.29	7.70	2.04	0.25
7	Plate Compactors		206.00	NA	2.81	5.34	486.00	0.29	7.70	2.04	0.25
7	Concrete Pavers		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Rollers		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Scrapers		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Paving Equipment		206.00	NA	3.00	5.02	486.00	0.29	7.70	2.04	0.25
7	Surfacing Equipment		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Signal Boards		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Trenchers		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Bore/Drill Rigs		206.00	NA	82.62	0.42	486.00	0.29	7.70	2.04	0.25
7	Excavators		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Concrete/Industrial Saws		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Cement and Mortar Mixers		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Cranes		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Graders		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Off-Highway Trucks		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Crushing/Proc. Equipment		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Rough Terrain Forklifts		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Rubber Tired Loaders		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Rubber Tired Dozers		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Tractors/Loaders/Backhoes		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Crawler Tractors		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Skid Steer Loaders		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Off-Highway Tractors		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Dumpers/Tenders		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Other Construction Equipment		NA	NA	NA	NA	NA	NA	NA	NA	NA
8	2-Wheel Tractors		NA	NA	NA	NA	NA	NA	NA	NA	NA
8	Agricultural Tractors		NA	NA	NA	NA	NA	NA	NA	NA	NA
8	Agricultural Mowers		NA	NA	NA	NA	NA	NA	NA	NA	NA
8	Combines		NA	NA	NA	NA	NA	NA	NA	NA	NA
8	Sprayers		NA	NA	NA	NA	NA	NA	NA	NA	NA
8	Balers		NA	NA	NA	NA	NA	NA	NA	NA	NA
			NA	NA	NA	NA	NA	NA	NA	NA	NA
8	Tillers >5 HP		NA	NA	NA	NA	NA	NA	NA	NA	NA
8	Swathers		NA	NA	NA	NA	NA	NA	NA	NA	NA
8	Hydro Power Units		NA	NA	NA	NA	NA	NA	NA	NA	NA
8	Other Agricultural Equipment		NA	NA	NA	NA	NA	NA	NA	NA	NA
9	Chainsaws >4 HP		152.00	NA	0.66	18.22	513.00	0.96	3.60	1.60	0.37
9	Shredders >5 HP		NA	NA	NA	NA	NA	NA	NA	NA	NA
9	Skidders		NA	NA	NA	NA	NA	NA	NA	NA	NA
9	Fellers/Bunchers		NA	NA	NA	NA	NA	NA	NA	NA	NA
2	Aircraft Support Equipment		NA	NA	NA	NA	NA	NA	NA	NA	NA
2	Terminal Tractors	**	3.00	0.99	17.13	0.52	63.70	17.90	0.05	0.22	0.00
4	Vessels w/Inboard Engines	***	728.06	NA	260.10	5.13	1357.34	8.77	48.10	3.07	2.90
4	Vessels w/Outboard Engines	***	728.06	NA	NA	8.75	1357.34	8.77	48.10	3.07	2.90
4	Vessels w/Sterndrive Engines	***	728.06	NA	63.00	5.26	1357.34	8.77	48.10	3.07	2.90
4	Sailboat Auxiliary Inboard Engines	***	NA	NA	NA	NA	NA	NA	NA	NA	NA
4	Sailboat Auxiliary Outboard Engines	***	728.06	NA	NA	8.75	1357.34	8.77	48.10	3.07	2.90

* g/hr
** Emission factors for 4-stroke propane-fueled equipment
*** g/gallon
NA = Not applicable

Table I-02. (cont.)

e.) GASOLINE 2-STROKE EQUIPMENT - IN-USE ADJUSTED (grams/hp-hr)
Adjusted for In-Use Effects HC

Class	Equipment Types		EXHAUST	CRANK	EVAP g/day	REFUELING g/hp-hr	CO	NOx	PM	ALDEHYDE	SOX
1	Trimmers/Edgers/Brush Cutters	d	471.58	NA	0.54	21.98	1383.62	0.91	3.89	2.04	0.54
1	Lawn Mowers	d	436.80	NA	1.16	8.60	923.40	0.29	7.70	2.04	0.54
1	Leaf Blowers/Vacuums	d	462.11	NA	0.61	6.61	1361.94	0.96	3.60	2.04	0.54
1	Rear Engine Riding Mowers		NA	NA	NA	NA	NA	NA	NA	NA	NA
1	Front Mowers		NA	NA	NA	NA	NA	NA	NA	NA	NA
1	Chainsaws <4 HP	d	625.80	NA	0.32	36.93	1328.10	0.96	3.60	1.60	0.54
1	Shredders <5 HP	d	436.80	NA	1.75	7.68	923.40	0.29	7.70	2.04	0.54
1	Tillers <5 HP	d	436.80	NA	1.38	9.39	923.40	0.29	7.70	2.04	0.54
1	Lawn & Garden Tractors		NA	NA	NA	NA	NA	NA	NA	NA	NA
1	Wood Splitters		NA	NA	NA	NA	NA	NA	NA	NA	NA
1	Snowblowers	d	436.80	NA	2.50	5.82	923.40	0.29	7.70	2.04	0.54
1	Chippers/Stump Grinders		NA	NA	NA	NA	NA	NA	NA	NA	NA
1	Commercial Turf Equipment	d	436.80	NA	15.50	1.38	923.40	0.29	7.70	2.04	0.54
1	Other Lawn & Garden Equipment	d	436.80	NA	1.16	8.60	923.40	0.29	7.70	2.04	0.54
3	All Terrain Vehicles (ATVs)	*, d	1260.00	NA	6.00	31.15	1620.00	1.50	8.20	2.75	0.96
3	Minibikes		NA	NA	NA	NA	NA	NA	NA	NA	NA
3	Off-Road Motorcycles	*, d	1260.00	NA	6.00	30.92	1620.00	1.50	8.20	2.75	0.96
3	Golf Carts	*, d	1260.00	NA	18.00	5.44	1620.00	1.50	8.20	2.75	0.96
3	Snowmobiles	d	228.90	NA	24.24	0.67	321.10	1.70	4.80	0.40	0.15
3	Specialty Vehicles Carts	*, d	1260.00	NA	18.00	7.04	1620.00	1.50	8.20	2.75	0.96
5	Generator Sets <50 HP	d	436.80	NA	3.06	3.43	923.40	0.29	7.70	2.04	0.27
5	Pumps <50 HP	**, b	8.99	1.41	2.25	6.33	214.70	2.82	0.18	0.22	0.00
5	Air Compressors <50 HP		NA	NA	NA	NA	NA	NA	NA	NA	NA
5	Gas Compressors <50 HP	**, c	6.42	1.41	NA	NA	146.90	7.04	0.06	0.22	0.00
5	Welders <50 HP		NA	NA	NA	NA	NA	NA	NA	NA	NA
5	Pressure Washers <50 HP		NA	NA	NA	NA	NA	NA	NA	NA	NA
6	Aerial Lifts	**, c	4.50	1.49	55.06	0.49	82.81	17.90	0.06	0.22	0.00
6	Forklifts	**, c	4.50	1.49	54.00	0.49	82.81	17.90	0.06	0.22	0.00
6	Sweepers/Scrubbers	**, c	4.50	1.49	59.67	0.48	82.81	17.90	0.06	0.22	0.00
6	Other General Industrial Equipment	c	312.00	NA	29.07	0.93	631.80	0.29	7.70	2.04	0.27
6	Other Material Handling Equipment		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Asphalt Pavers		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Tampers/Rammers	d	436.80	NA	2.81	5.34	923.40	0.29	7.70	2.04	0.25
7	Plate Compactors	d	436.80	NA	2.81	5.34	923.40	0.29	7.70	2.04	0.25
7	Concrete Pavers		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Rollers		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Scrapers		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Paving Equipment	d	436.80	NA	3.00	5.02	923.40	0.29	7.70	2.04	0.25
7	Surfacing Equipment		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Signal Boards		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Trenchers		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Bore/Drill Rigs	d	436.80	NA	82.62	0.42	923.40	0.29	7.70	2.04	0.25
7	Excavators		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Concrete/Industrial Saws		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Cement and Mortar Mixers		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Cranes		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Graders		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Off-Highway Trucks		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Crushing/Proc. Equipment		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Rough Terrain Forklifts		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Rubber Tired Loaders		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Rubber Tired Dozers		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Tractors/Loaders/Backhoes		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Crawler Tractors		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Skid Steer Loaders		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Off-Highway Tractors		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Dumpers/Tenders		NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Other Construction Equipment		NA	NA	NA	NA	NA	NA	NA	NA	NA
8	2-Wheel Tractors		NA	NA	NA	NA	NA	NA	NA	NA	NA
8	Agricultural Tractors		NA	NA	NA	NA	NA	NA	NA	NA	NA
8	Agricultural Mowers		NA	NA	NA	NA	NA	NA	NA	NA	NA
8	Combines		NA	NA	NA	NA	NA	NA	NA	NA	NA
8	Sprayers		NA	NA	NA	NA	NA	NA	NA	NA	NA
8	Balers		NA	NA	NA	NA	NA	NA	NA	NA	NA
			NA	NA	NA	NA	NA	NA	NA	NA	NA
8	Tillers >5 HP		NA	NA	NA	NA	NA	NA	NA	NA	NA
8	Swathers		NA	NA	NA	NA	NA	NA	NA	NA	NA
8	Hydro Power Units		NA	NA	NA	NA	NA	NA	NA	NA	NA
8	Other Agricultural Equipment		NA	NA	NA	NA	NA	NA	NA	NA	NA
9	Chainsaws >4 HP	d	319.20	NA	0.66	18.22	974.70	0.96	12.96	1.60	0.37
9	Shredders >5 HP		NA	NA	NA	NA	NA	NA	NA	NA	NA
9	Skidders		NA	NA	NA	NA	NA	NA	NA	NA	NA
9	Fellers/Bunchers		NA	NA	NA	NA	NA	NA	NA	NA	NA
2	Aircraft Support Equipment		NA	NA	NA	NA	NA	NA	NA	NA	NA
2	Terminal Tractors	**, c	4.50	0.99	17.13	0.52	82.81	17.90	0.05	0.22	0.00
4	Vessels w/Inboard Engines	***, c	873.67	NA	260.10	5.13	1628.81	8.77	48.10	3.07	2.90
4	Vessels w/Outboard Engines	***, e	873.67	NA	NA	8.75	1628.81	8.77	48.10	3.07	2.90
4	Vessels w/Sterndrive Engines	***, c	873.67	NA	63.00	5.26	1628.81	8.77	48.10	3.07	2.90
4	Sailboat Auxiliary Inboard Engines		NA	NA	NA	NA	NA	NA	NA	NA	NA
4	Sailboat Auxiliary Outboard Engines	***, e	873.67	NA	NA	8.75	1628.81	8.77	48.10	3.07	2.90

* g/hr
** Emission factors for 4-stroke propane-fueled equipment
*** g/gallon
b = adjusted for in-use effects using small utility engine data
c = adjusted for in-use effects using heavy duty engine data
d = adjusted for in-use effects using small utility engine data except no NOx or PM adjustment
e = adjusted for in-use effects by a factor of 1.2 for HC and CO.
NA = Not Applicable

TABLE I-03
EMISSION FACTORS FOR FOUR-STROKE UTILITY, LAWN & GARDEN EQUIPMENT

							CARB TSD EMISSION FACTORS					CARB TSD EMISSION FACTORS j			
	NATIONAL POPULATION	HOURS/YR	AVG HP	LOAD FACTOR	HP HOURS PER YEAR	HP HRS FRACTION	HC G/HP-HR	CO G/HP-HR	NOX G/HP-HR	PM G/HP-HR	BSFC LB/HP-HR	HC G/GALLON	CO G/GALLON	NOX G/GALLON	PM G/GALLON
CONSUMER WBM	27360000 a	23	3.5	0.36	792892800	0.1689	37.7	430	2.02	0.74	1.36 g	171.87	1960.29	9.21	3.37
COMMERCIAL WBM	1360000 b	368	4	0.36	720691200	0.1535	37.7	430	2.02	0.74	1.36	171.87	1960.29	9.21	3.37
MULTI-SPINDLE WBM (COMM.)	100000	800	13	0.42	436800000	0.0930	9.3	353	2.03	0.05	0.928 h	62.13	2358.41	13.56	0.33
RIDING MOWERS (CONSUMER)	2000000	36	13	0.42	393120000	0.0837	9.3	353	2.03	0.05	0.928	62.13	2358.41	13.56	0.33
LAWN TRACTORS (CONSUMER)	4000000	40	15	0.6	1440000000	0.3067	9.6	357	2.3	0.21	1.05 i	56.69	2108.00	13.58	1.24
GARDEN TRACTORS (CONSUMER)	1333000	53	15	0.6	635841000	0.1354	9.6	357	2.3	0.21	1.05	56.69	2108.00	13.58	1.24
CONSUMER TILLERS	2706000 c	18	5	0.4	97416000	0.0207	37.7	430	2.02	0.74	1.36	171.87	1960.29	9.21	3.37
COMMERCIAL TILLERS	594000 d	72	6	0.4	102643200	0.0219	37.7	430	2.02	0.74	1.36	171.87	1960.29	9.21	3.37
CONSUMER MISC. L & G	1368000 e	23	3.5	0.36	39644640	0.0084	37.7	430	2.02	0.74	1.36	171.87	1960.29	9.21	3.37
COMMERCIAL MISC. L & G	68000 f	368	4	0.36	36034560	0.0077	9.3	353	2.03	0.05	1.36	42.40	1609.26	9.25	0.23
TOTAL	40889000				4695083400	1									
POPULATION WEIGHTED EMISSION FACTORS (G/HP-HR)							20.04	383.52	2.15	0.38					
POPULATION WEIGHTED EMISSION FACTORS (G/GALLON)							100.55	2093.28	11.91	1.87					

a assuming 90% consumer, 95% 4-stroke
b assuming 10% commercial, 85% 4-stroke
c assuming 60% consumer
d assuming 40% commercial
e assuming 90% consumer, 95% 4-stroke
f assuming 10% commercial, 85% 4-stroke
g assuming 95% side valve, 5% OHV from page 60 of CARB TSD small engine
h assuming 90% side valve, 10% OHV from page 60 of CARB TSD midsize engine
i source = SwRI SAE 910560 pg. 132, 18 hp engine
j density of gasoline assumed to be 6.2 lb/gallon

TABLE I-04
EMISSION FACTORS FOR TWO-STROKE UTILITY, LAWN & GARDEN EQUIPMENT

							CARB TSD EMISSION FACTORS					CARB TSD EMISSION FACTORS f			
	NATIONAL POPULATION	HOURS/YR	AVG HP	LOAD FACTOR	HP HOURS PER YEAR	HP HRS FRACTION	HC G/HP-HR	CO G/HP-HR	NOX G/HP-HR	PM G/HP-HR	BSFC LB/HP-HR	HC G/GALLON	CO G/GALLON	NOX G/GALLON	PM G/GALLON
CONSUMER WBM	3040000 a	23	3.5	0.36	88099200	0.1132	208	486	0.29	7.7	1.32 e	976.97	2282.73	1.36	36.17
COMMERCIAL WBM	240000 b	368	4	0.36	127180800	0.1635	208	486	0.29	7.7	1.32	976.97	2282.73	1.36	36.17
WB CONSUMER MISC. L & G	152000 c	23	3.5	0.36	4404960	0.0057	208	486	0.29	7.7	1.32	976.97	2282.73	1.36	36.17
WB COMMERCIAL MISC. L & G	12000 d	368	4	0.36	6359040	0.0082	208	486	0.29	7.7	1.32	976.97	2282.73	1.36	36.17
HH CONSUMER CHAIN SAWS	7553754	7	1.5	0.5	39657208.5	0.0510	298	699	0.96	3.6	1.32	1399.70	3283.18	4.51	16.91
HH COMMERCIAL CHAIN SAWS	314740	405	4.1	0.5	261312885	0.3358	152	513	0.96	3.6	1.32	713.94	2409.55	4.51	16.91
HH CONSUMER TRIMMERS/BRUSHCUT.	12531470	10	0.7	0.5	43860145	0.0564	287	920	0.96	3.6	1.32	1348.03	4321.21	4.51	16.91
HH COMMERCIAL TRIMMERS/BRUSHCUT	596737	170	1.9	0.5	96373025.5	0.1239	198	668	0.96	3.6	1.32	930.00	3137.58	4.51	16.91
HH CONSUMER BLOWERS	3146857	9	0.8	0.5	11328685.2	0.0146	283	908	0.96	3.6	1.32	1329.24	4264.85	4.51	16.91
HH COMMERCIAL BLOWERS	49662	197	0.8	0.5	3913365.6	0.0050	283	908	0.96	3.6	1.32	1329.24	4264.85	4.51	16.91
HH CONSUMER BACKPACK BLOWER	25855	12	3	0.5	465390	0.0006	198	668	0.96	3.6	1.32	930.00	3137.58	4.51	16.91
HH COMMERCIAL BACKPACK BLOWER	134781	293	3	0.5	59236249.5	0.0761	198	668	0.96	3.6	1.32	930.00	3137.58	4.51	16.91
HH CONSUMER HEDGETRIMMER	178682	7	0.7	0.5	437770.9	0.0006	287	920	0.96	3.6	1.32	1348.03	4321.21	4.51	16.91
HH COMMERCIAL HEDGETRIMMER	268874	75	1.9	0.5	19157272.5	0.0246	198	668	0.96	3.6	1.32	930.00	3137.58	4.51	16.91
HH COMMERCIAL CUT-OFF SAW	70404	113	4.1	0.5	16309086.6	0.0210	152	513	0.96	3.6	1.32	713.94	2409.55	4.51	16.91
TOTAL	28315816				778095084	1									
POPULATION WEIGHTED EMISSION FACTORS (G/HP-HR)							196.32	580.45	0.77	4.79					
POPULATION WEIGHTED EMISSION FACTORS (G/GALLON)							922.11	2726.36	3.59	22.50					

a assuming 90% consumer, 5% 2-stroke
b assuming 10% commercial, 15% 2-stroke
c assuming 90% consumer, 5% 2-stroke
d assuming 10% commercial, 15% 2-stroke
e SWRI SAE 910560 PG. 133 & 134
f density of gasoline assumed to be 6.2 lb/gallon

WB = walk behind
HH = hand held

TABLE I-05
LAWN AND GARDEN EQUIPMENT EMISSION FACTOR DERIVATION FOR INVENTORIES A AND B

TRIMMERS/EDGERS/BRUSHCUTTERS

FOUR STROKE	NATIONAL POPULATION	HOURS/YR	AVG HP	LOAD FACTOR	HP HOURS PER YEAR	HP HRS FRACTION	HC G/HP-HR	CO G/HP-HR	NOX G/HP-HR	PM G/HP-HR
CONSUMER MISC. L & G	1368000 a	23	3.5	0.36	39644640	0.5239	37.7	430	2.02	0.74
COMMERCIAL MISC. L & G	68000 b	368	4	0.36	36034560	0.4761	9.3	353	2.03	0.05
TOTAL	1436000				75679200	1				
POPULATION WEIGHTED EMISSION FACTORS (G/HP-HR)							24.18	393.34	2.02	0.41

a assuming 95% consumer, 90% 4-stroke

b assuming 5% commercial, 85% 4-stroke

TWO STROKE	NATIONAL POPULATION	HOURS/YR	AVG HP	LOAD FACTOR	HP HOURS PER YEAR	HP HRS FRACTION	HC G/HP-HR	CO G/HP-HR	NOX G/HP-HR	PM G/HP-HR
WB CONSUMER MISC. L & G	152000 c	23	3.5	0.36	4404960	0.0292	208	486	0.29	7.7
WB COMMERCIAL MISC. L & G	12000 d	368	4	0.36	6359040	0.0421	208	486	0.29	7.7
HH CONSUMER TRIMMERS	12531470	10	0.7	0.5	43860145	0.2905	287	920	0.96	3.6
HH COMMERCIAL TRIMMERS	596737	170	1.9	0.5	96373025.5	0.6382	198	668	0.96	3.6
TOTAL	13292207				150997170.5	1				
POPULATION WEIGHTED EMISSION FACTORS (G/HP-HR)							224.56	728.22	0.91	3.89

c assuming 95% consumer, 10% 2-stroke

d assuming 5% commercial, 15% 2-stroke

TABLE I-05 (cont.)

LEAF BLOWERS/VACCUMS

FOUR STROKE - SEE TRIMMERS/EDGERS/BRUSHCUTTERS	HC G/HP-HR	CO G/HP-HR	NOX G/HP-HR	PM G/HP-HR
POPULATION WEIGHTED EMISSION FACTORS (G/HP-HR)	24.18	393.34	2.02	0.41

TWO STROKE	NATIONAL POPULATION	HOURS/YR	AVG HP	LOAD FACTOR	HP HOURS PER YEAR	HP HRS FRACTION	HC G/HP-HR	CO G/HP-HR	NOX G/HP-HR	PM G/HP-HR
HH CONSUMER BLOWERS	3146857	9	0.8	0.5	11328685.2	0.1512	283	908	0.96	3.6
HH COMMERCIAL BLOWERS	49662	197	0.8	0.5	3913365.6	0.0522	283	908	0.96	3.6
CONSUMER BACKPACK BLOWERS	25855	12	3	0.5	465390	0.0062	198	668	0.96	3.6
COMMERCIAL BACKPACK BLOWE	134781	293	3	0.5	59236249.5	0.7904	198	668	0.96	3.6
TOTAL	3357155				74943690.3	1				
POPULATION WEIGHTED EMISSION FACTORS (G/HP-HR)							215.29	716.81	0.96	3.60

REAR RIDING MOWERS

FRONT MOWERS

	HC	CO	NOx	PM
SOURCE: CARB TSD MID SIZE ENGINE	9.3	353	2.03	0.05

CHAIN SAWS <5HP

	HC	CO	NOx	PM
SOURCE: CARB TSD CONSUMER CHAIN SAWS	298	699	0.96	3.6

SHREDDERS <5HP

TILLERS <5HP

	HC	CO	NOx	PM
SOURCE: CARB TSD SMALL ENGINE	37.7	430	2.02	0.74

TABLE I-06

ENGINE MANUFACTURERS ASSOCIATION
NONROAD DIESEL-POWERED EQUIPMENT EMISSION FACTORS

All manufacturers' data collected using the 8 Mode Emissions Test Cycle and Weighing Factors (ISO-8178)

Equipment Category	Engine Population Weighted Emissions (g/bhp-hr)		
	NO_x	HC	CO
1. Crawler tractor	10.3	0.9	2.4
2. Crawler loader	10.0	0.6	2.4
3. Wheel loader	10.3	0.6	2.4
4. Scraper	8.7	0.5	2.5
5. Motor grader	9.6	1.1	1.9
6. Dumper	8.1	0.6	1.4
7. Crawler excavator	10.5	0.6	2.5
8. Wheel excavator	11.0	0.4	2.8
9. Backhoe loader	10.1	1.0	3.4
10. Skid steer loader	9.6	1.5	4.5
11. Log skidder	11.3	0.6	2.6
12. Crane	10.3	0.9	2.1
13. Roller and compactor	9.3	0.8	3.1
14. Paver	10.3	0.6	3.2
15. Farm tractor	10.5	0.7	3.2
16. Grain combine	11.5	0.9	2.1
17. Cotton picker	12.0	0.5	2.2

TABLE I-07
CAL/ERT AGRICULTURAL EQUIPMENT EMISSION FACTORS

G/BHP-HR

a.) DIESEL TRACTORS

	%ENERGY	%ENERGY	EFs G/BHP-HR			TRACTOR ENERGY WEIGHT		
	OUTPUT	TRACTOR	HC	CO	NOX	HC	CO	NOX
2WD 100+ HP	33.0%	39.1%	1.84	4.23	11.59	0.71858	1.65195	4.52627
4WD	29.5%	34.9%	0.89	3.28	10.98	0.31071	1.14509	3.83325
2WD 20-90 HP	22.0%	26.0%	2.16	6.42	10.94	0.56237	1.67148	2.84828
			WEIGHTED EMISSION FACTORS			1.59	4.47	11.21

b.) DIESEL NONTRACTORS

	%ENERGY	%ENERGY	EFs G/BHP-HR			NONTRACTOR ENERGY WEIGHT		
	OUTPUT	NONTRAC	HC	CO	NOX	HC	CO	NOX
COMBINES	5.8%	37.4%	1.9	3.25	13.36	0.71097	1.21613	4.99923
WINDROWER	4.3%	27.7%	2.21	6.85	10.5	0.6131	1.90032	2.9129
FORAGE HARVESTER SWEET CORN HARVESTER	2.0%	12.9%	0.96	2.84	9.98	0.12387	0.36645	1.28774
BALERS COTTON PICKERS COTTON STRIPPERS ORCHARD SPRAYERS	1.7%	11.0%	2.23	3.78	7.78	0.24458	0.41458	0.85329
MOWER CONDITIONER COMPACT LOADERS	1.7%	11.0%	1.13	4.29	9.69	0.12394	0.47052	1.06277
			WEIGHTED EMISSION FACTORS			1.82	4.37	11.12

c.) GASOLINE

	EFs G/BHP-HR		
	HC	CO	NOX
TRACTOR	2.8	163	7.8
NONTRACTOR	2.8	163	7.8

TABLE I-08
CAL/ERT AGRICULTURAL EQUIPMENT EMISSION FACTORS

LB/KGAL*

a.) DIESEL TRACTORS

			EFs					
	%ENERGY	%ENERGY	LB/1000GAL*			TRACTOR ENERGY WEIGHT		
	OUTPUT	TRACTOR	HC	CO	NOX	HC	CO	NOX
2WD 100+ HP	33.0%	39.1%	72.0034	165.529	453.543	28.1197	64.6446	177.123
4WD	29.5%	34.9%	34.8277	128.354	429.672	12.1588	44.8099	150.004
2WD 20-90 HP	22.0%	26.0%	84.5257	251.229	428.107	22.0067	65.4088	111.46
WEIGHTED EMISSION FACTORS						62.29	174.86	438.59

b.) DIESEL NONTRACTORS

			EFs					
	%ENERGY	%ENERGY	LB/1000GAL*			NONTRACTOR ENERGY WEIGHT		
	OUTPUT	NONTRAC	HC	CO	NOX	HC	CO	NOX
COMBINES	5.8%	37.4%	74.3513	127.18	522.807	27.8218	47.5899	195.631
WINDROWER	4.3%	27.7%	86.4823	268.056	410.889	23.9919	74.3639	113.988
FORAGE HARVESTER SWEET CORN HARVESTER	2.0%	12.9%	37.567	111.136	390.54	4.84735	14.3401	50.3922
BALERS COTTON PICKERS COTTON STRIPPERS ORCHARD SPRAYERS	1.7%	11.0%	87.2649	147.92	304.449	9.57099	16.2235	33.3912
MOWER CONDITIONER COMPACT LOADERS	1.7%	11.0%	44.2194	167.877	379.192	4.84988	18.4124	41.5888
WEIGHTED EMISSION FACTORS						71.08	170.93	434.99

* [(G/BHP-HR)/(0.4 LB FUEL/HP-HR)][1 LB/453.59G][7.1 LB FUEL/1 GAL][1000]

C.) GASOLINE

	EFs		
	LB/1000GAL**		
	HC	CO	NOX
TRACTOR	76.5449	4456.01	213.232
NONTRACTOR	76.5449	4456.01	213.232

** [(G/BHP-HR)/(0.5 LB FUEL/HP-HR)][1 LB/453.59G][6.2 LB FUEL/1 GAL][1000]

TABLE I-09
COMPARISON OF AP-42 (CAL/ERT) AND EMA CONSTRUCTION EQUIPMENT EMISSION FACTORS

DIESEL G/HP-HR

		HC		CO		NOX	
AP-42	EMA	AP-42	EMA	AP-42	EMA	AP-42	EMA
TRACKED TRACTORS	CRAWLER TRACTOR	0.75	0.9	2.15	2.4	7.81	10.3
TRACKED LOADERS	CRAWLER LOADER	1.11	0.6	2.26	2.4	9.3	10
MOTOR GRADERS	MOTOR GRADER	0.36	1.1	1.54	1.9	7.14	9.6
SCRAPERS	SCRAPER	0.55	0.5	2.45	2.5	7.46	8.7
OFF HIGHWAY TRUCKS	DUMPER	0.37	0.6	2.28	1.4	8.15	9.6
PAVEMENT COLD PLANERS							
WHEEL DOZERS							
WHEELED LOADERS	WHEEL LOADER	0.97	0.6	2.71	2.4	8.81	10.3
WHEELED TRACTORS		1.76		7.34		11.91	
ROLLERS	ROLLER & COMPACTOR	0.97	0.8	6.03	3.1	13.05	9.3
WHEELED DOZERS		0.37		2.28		8.15	
MISCELLANEOUS		1.01		4.6		11.01	
LOG SKIDDERS	LOG SKIDDERS	0.61	0.6	3.18	2.6	9.82	11.3
HYD EXCAV./CRAWLERS	CRAWLER EXCAVATOR	1.22	0.6	3.18	2.5	11.01	10.5
TRENCHERS		1.1		4.57		10.02	
CONCRETE PAVERS		1.1		4.57		10.02	
COMPACT LOADERS	BACKHOE LOADERS	1.1	1	4.57	3.4	10.02	10.1
	SKID STEER LOADER		1.5		4.5		9.6
CRANE LATTICE BOOMS		0.59		4.99		12.45	
CRANES	CRANE	0.8	0.9	7.8	2.1	14.69	10.3
HYD. EXCAV. WHEELS	WHEEL EXCAVATOR	1.22	0.4	3.18	2.8	11.01	11
BITUMINOUS PAVERS	PAVER	0.99	0.6	5.19	3.2	11.18	10.3

TABLE I-10 Results of EPA/Industry Test Cylce Evaluation Program
1991 nonroad version engines

Engine	HC g/hp-hr		CO g/hp-hr		NOx g/hp-hr		g/hp-hr	
	FTP	8mode	FTP	8mode	FTP	8mode	FTP	8mode
100 HP	1.08	0.8	2.7	2.2	12.14	11.1	0.59	0.41
139 HP	0.86	0.48	3.61	3.07	10.81	11.67	0.4	0.44
285 HP	1.81	1.21	5.06	1.49	6.55	6.5	0.58	0.2
450 HP	0.38	0.36	3.81	0.8	11.18	12.1	0.26	0.12
Average	1.0325	0.7125	3.795	1.89	10.17	10.3425	0.4575	0.2925
Avg. FTP/ Avg. 8mode		1.4		2.0		1.0		1.6

TABLE I-11 DERIVATION OF MARINE ENGINE EMISSION FACTORS

a.) 2-STROKE OUTBOARDS

POWER CATEGORY	SURVEY DISTRIB. (N)	ASSUMED HP (HP)	POWER FACTOR (PF)	BSE (grams/hp-hr) HC	CO	NOx	N*HP*PF*BSE (g/hr) HC	CO	NOx	BSFC (gal/hp-hr)	N*HP*PF*BSFC (gal/hr)
5 HP & under	0.07	4	0.2746	312.82	414.61	0.52	24.05	31.88	0.04	0.33	0.03
6-15	0.19	10.5	0.2746	198.98	308.97	0.92	109.01	189.28	0.50	0.24	0.13
16-35	0.14	25.5	0.2033	132.24	192.39	1.86	95.98	139.63	1.35	0.16	0.12
36-74	0.22	55	0.2818	115.33	188.67	1.99	393.27	636.52	6.78	0.17	0.56
75-149	0.29	112	0.1884	110.55	235.64	1.31	712.39	1518.48	8.47	0.15	0.97
150 & over	0.09	215	0.1884	113.84	210.29	1.09	437.05	807.30	4.20	0.16	0.61
	1						1771.74	3303.07	21.35		2.43

SUM(N*HP*PF*BSE)/SUM(N*HP*PF*BSFC)

	HC	CO	NOx
grams/gallor	728.06	1357.34	8.77
lbs/gallon	1.61	2.99	0.02

b.) 4-STROKE OUTBOARDS

POWER (HP)	BSE (g/kWh) HC	CO	NOx	BSE (g/hp-hr) HC	CO	NOx	FUEL BASED EF's (pounds/gal) HC	CO	NOx	FUEL BASED EF's (grams/gal) HC	CO	NOx	POWER FACTOR	HP*PF*BSE (grams/hr) HC	CO	NOx	BSFC	HP*PF*BSFC (gallons/hr)
10	18.5	291	4.4	14	217	3.3	0.22	3.47	0.052	99.790	1573.957	23.587	0.2033	28.046	441.158	6.670	0.138	0.281
35	14	241	10.2	10	180	7.6	0.199	3.43	0.145	90.264	1555.814	65.771	0.2033	74.284	1278.753	54.121	0.116	0.825
45	11.1	171	10.9	8	128	8.1	0.181	2.79	0.178	82.100	1265.516	80.739	0.2033	75.725	1166.568	74.360	0.101	0.924
														178.055	2886.479	135.152		2.030

SUM(HP*PF*BSE)/SUM(HP*PF*BSFC)

	HC	CO	NOx
grams/gallor	87.71	1421.95	66.58
lbs/gallon	0.19	3.13	0.15

TABLE 1-11 (cont.)

c.) 4-STROKE GASOLINE STERNDRIVES/INBOARDS

POWER	BSE (g/kWh)			BSE (g/hp-hr)			FUEL BASED EF's (pounds/gal)			FUEL BASED EF's (grams/gal)			POWER	HP*PF*BSE (grams/hr)			BSFC	HP*PF*BSF
(HP)	HC	CO	NOx	HC	CO	NOx	HC	CO	NOx	HC	CO	NOx	FACTOR	HC	CO	NOx		(gallons/hr)
120	8.6	200	4.3	6	149	3.2	0.14	3.26	0.07	63.5026	1478.703	31.7513	0.2	153.91	3579.36	76.96	0.1	2.4
165	15.4	184	6.8	11	137	5.1	0.253	3.03	0.112	114.7583	1374.378	50.80208	0.2	378.96	4527.89	167.34	0.1	3.3
200	5.7	123	6.7	4	92	5.0	0.094	2.03	0.111	42.63746	920.7877	50.34849	0.2	170.02	3668.84	199.85	0.1	4
														702.90	11776.09	444.14		9.7

SUM(HP*PF*BSE)/SUM(HP*PF*BSFC)

	HC	CO	NOx
grams/gallor	72.46	1214.03	45.79
lbs/gallon	0.16	2.68	0.10

d.) DIESEL SAILBOAT AUXILLARY
LB/GALLON

	HC	CO	NOx
lb/gallon	0.27	0.48	0.36
g/gallon	122.47	217.72	163.29

e.) DIESEL INBOARD

POWER	BSE (g/kWh)			BSE (g/hp-hr)			HP*BSE (grams/hr)			BSFC	HP*BSFC
(HP)	HC	CO	NOx	HC	CO	NOx	HC	CO	NOx		(gallons/hr)
143	3	4.6	17.5	2	3	13.0	319.91	490.52	1866.11	0.066	9.438
177	1.1	1.4	12.2	1	1	9.1	145.19	184.78	1610.26	0.066	11.682
197	2.5	4	16.4	2	3	12.2	367.26	587.61	2409.21	0.066	13.002
							832.35	1262.92	5885.59		34.122

SUM(HP*PF*BSE)/SUM(HP*PF*BSFC)

	HC	CO	NOx
grams/gallor	24.39	37.01	172.49
lbs/gallon	0.05	0.08	0.38

TABLE I-12 Emission Factors for Commercial Marine Vessels

a.) AVERAGE EMISSION FACTORS
FOR
OCEAN-GOING COMMERCIAL VESSELS

POUNDS OF POLLUTANT PER THOUSAND GALLONS OF FUEL CONSUMED

OPERATING PLANT Operating Mode/Rated Output	POLLUTANT				
	NOx	HC	CO	SOx	PM
STEAM PROPULSION					
Full power	63.6	1.72	7.27	159x(%S)	56.5
Maneuver/Cruise	55.8	0.682	3.45	159x(%S)	20
Hotelling					
- Burning residual bunker fuel	36.4	3.2	*	159x(%S)	10
- Burning distillate oil	22.2	3	4	142x(%S)	15
MOTOR PROPULSION					
All underway operating modes	550	24	61	157x(%S)	33
AUXILIARY DIESEL GENERATORS					
- 20 KW (50% Load)	477	144	53.4	27	17
- 40 KW (50% Load)	226	285	67.6	27	17
- 200 KW (50% Load)	140	17.8	62.3	27	17
- 500 KW (50% Load)	293	81.9	48.1	27	17

Notes:
1. Emission factors showing an asterisk (*) are considered negligible for these operating modes.
2. Average sulfur concentrations used are 0.8 percent for marine diesel, and 2.0 percent for bunker fuel oil.

Sources:
1. U.S. Environmental Protection Agency, Compilation of Air Pollutant Emission Factors, 1985
2. U.S. Department of Transportation, Port Vessel Emissions Model, 1986
3. California Air Resources Board, Report to the California Legislature on Air Pollutant Emissions from Marine Vessels

TABLE I-12 (cont.)

b.) AVERAGE EMISSION FACTORS
FOR
HARBOR AND FISHING VESSELS

OPERATING PLANT Operating Mode/Rated Output	POLLUTANT				
	NOx	HC	CO	SOx	PM
	POUNDS PER THOUSAND GALLONS OF FUEL CONSUMED				
DIESEL ENGINES					
< 500 Horsepower					
Full	275.1	21	58.5	157x(%S)	17
Cruise	389.3	51.1	47.3	157x(%S)	17
Slow	337.5	56.7	59	157x(%S)	17
500 - 1000 Horsepower					
Full	300	24	61	157x(%S)	17
Cruise	300	17.1	80.9	157x(%S)	17
Slow	167.2	16.8	62.2	157x(%S)	17
1000 - 1500 Horsepower					
Full	300	24	61	157x(%S)	17
Cruise	300	24	61	157x(%S)	17
Slow	300	24	61	157x(%S)	17
1500 - 2000 Horsepower					
Full	472	16.8	237.7	157x(%S)	17
Cruise	623.1	24	44.6	157x(%S)	17
Slow	371.3	24	122.4	157x(%S)	17
2000+ Horsepower					
Full	399.6	21.3	95.9	157x(%S)	17
Cruise	391.7	16.8	78.3	157x(%S)	17
Slow	419.6	22.6	59.8	157x(%S)	17
	NOx	HC	CO	SOx	PM
GASOLINE ENGINES	GRAMS PER BRAKE HORSEPOWER HOUR				
Exhaust Emissions - All HP Ratings	5.16	6.68	199	0.268	0.327
Evaporative Emissions		62.0	grams/hr		
Crankcase Blowby		38.3	grams/hr		

Notes: 1. Average sulfur concentration for marine diesel fuel = 0.8 percent

Sources:
1. U.S. Environmental Protection Agency, Compilation of Air Pollutant Emission Factors, 1985
2. U.S. Department of Transportation, Port Vessel Emissions Model, 1986
3. California Air Resources Board, Report to the California Legislature on Air Pollutant Emissions from Marine Vessels

TABLE I-13
MOTORCYCLE EMISSION FACTORS REPORTED IN CARB MAIL-OUT #90-58

			g/mile	
Vehicle Type	Engine Type	HC	CO	NOx
On-road Motorcycles	4-Stroke	2.12	13	1.06
Off-Road Motorcycles	4-Stroke	4	39	0.36
Off-Road Motorcycles	2-stroke	24	32	0.06

TABLE I-14
SwRI IN-USE SMALL UTILITY ENGINE TEST RESULTS

Engine	Test	HC g/hp-hr	HC test/EF	CO g/hp-hr	CO test/EF	NOx g/hp-hr	NOx test/EF	PM g/hp-hr	PM test/EF
FOUR-STROKE									
2yr WBM	1A	67.9	1.80	650	1.51	0.94	0.47	1.35	1.80
4yr WBM	1A	83.9	2.23	928	2.16	0.37	0.18	1.11	1.48
	2A	112.6	2.99	1033	2.40	0.47	0.23	2.05	2.73
8yr WBM	1A	VOID	0.00						
	2A	77.3	2.05	835	1.94	0.9	0.45	6.27	8.36
	3A	74.9	1.99	829	1.93	0.71	0.35	4.08	5.44
New engine emission factors		37.7		430		2.02		0.75	
In-use adjustment (average test/EF)			2.10		1.9		0.4		3.6
TWO-STROKE									
11yr WBM	1	187	0.90	415	0.85	0.51	1.76	5.75	0.75
	2	177	0.85	418	0.86	0.52	1.79	6.61	0.86
New engine emission factors		208		486		0.29		7.7	
4 yr String trimmer	1	1369	6.11	2244	3.11	0.77	0.86	61.3	15.36
	2	1205	5.38	1936	2.68	0.69	0.77	54.3	13.61
New engine emission factors		224		722		0.9		3.99	

Table I-15. Refueling and Evaporative Emission Factors - Gasoline

Manufacturer Data

	Average Gas Tank Volume
Edge Trimmers	0.29
Hedge Trimmer	0.12
String Trimmers	0.14
Walk Behind Mowers (commercial)	0.68
Walk Behind Mowers (consumer)	0.37
Blowers (hand held)	0.16
Blowers (walk behind)	0.83
Riding Mowers	1.10
Front End Mowers	6.20
Small Chain Saws <5 HP	0.11
Small Shredders <5 HP	0.58
Small Tillers <5HP	0.46
Lawn Tractors	2.25
Garden Tractors	3.09
Snow Blowers	0.83
Wide Area Walk-Behind Mowers	5.17
7 Hydro-Seeders/Mulchers	1.25
Four-Wheeled ATV's	2.00
Minibikes	0.50
Off-Road Motorcycles	2.00
Golf Carts	6.00
Snowmobiles	8.08
Outboard Motors	6.00
Portable Generators	1.13
Small Generator Sets	0.92
Pumps	0.75
Small Compressors	1.13
Welding Machines	3.25
Forklifts	18.00
Plate Compactors	0.94
Vibratory Roller Compactors	3.00
Vibrators/Finishers	1.00
Chain Trenchers	2.56
Concrete Saws	1.38
Cement Mixers <15 HP	1.25

	Equipment List	REFUELING EMISSIONS													EVAPORATIVE EMISSIONS						
		Average Gas Tank Volume	dT (Deg. F)	Td (Deg. F)	RVP	g displcd per gal. (g/gal)	g spilled per rflng (g/rflg)	g spilled per gal (g/gal)	Refuel. Subtot. (g/gal)	Mean HP	Load Factor	BSFC (gal/hp-h)	Final refuel. (g/hp-hr)	Final refuel. (g/hr)	Average Gas Tank Volume	Diurnal E.F. (g/gal/d)	subtotal (g/day)	Hot Soak	Rest. Loss	Run. Loss	Total Evap (g/day)
1	Trimmers/Edgers/Brush Cutters	0.18	0	76.2	10.5	5.92	17	94.44	100.36	1		0.22	[illegible]		0.18	3	0.54	0.00	0.00	0.00	0.54
2	Lawn Mowers	0.51	0	76.2	10.5	5.92	17	33.33	39.25	4		0.22	[illegible]		0.39	3	1.16	0.00	0.00	0.00	1.16
3	Leaf Blowers/Vacuums	0.70	0	76.2	10.5	5.92	17	24.29	30.21	2		0.22	[illegible]		0.20	3	0.61	0.00	0.00	0.00	0.61
	Rear Engine Riding Mowers	1.10	0	76.2	10.5	5.92	17	15.45	21.37	9		0.15	3.21		1.10	3	3.30	0.00	0.00	0.00	3.30
	Front Mowers	6.20	0	76.2	10.5	5.92	17	2.74	8.66	12		0.15	1.30		6.20	3	18.60	0.00	0.00	0.00	18.60
	Chainsaws <4 HP	0.11	0	76.2	10.5	5.92	17	158.14	164.06	2		0.22	[illegible]		0.11	3	0.32	0.00	0.00	0.00	0.32
	Shredders <5 HP	0.58	0	76.2	10.5	5.92	17	29.14	35.06	4		0.22	[illegible]		0.58	3	1.75	0.00	0.00	0.00	1.75
	Tillers <5 HP	0.46	0	76.2	10.5	5.92	17	36.96	42.88	4		0.22	[illegible]		0.46	3	1.38	0.00	0.00	0.00	1.38
4	Lawn & Garden Tractors	2.67	0	76.2	10.5	5.92	17	6.37	12.29	12		0.15	1.84		2.38	3	7.13	0.00	0.00	0.00	7.13
5	Wood Splitters	0.51	0	76.2	10.5	5.92	17	33.33	39.25	5		0.22	[illegible]		0.39	3	1.16	0.00	0.00	0.00	1.16
	Snowblowers	0.83	0	60.3	13.9	6.16	17	20.40	26.56	6		0.22	[illegible]		0.83	3	2.50	0.00	0.00	0.00	2.50
6	Chippers/Stump Grinders	31.62	8.8	76.2	10.5	5.08	3.6	0.11	5.20	62		0.08	0.42		31.62	3	94.86	0.00	0.00	0.00	94.86
	Commercial Turf Equipment	5.17	0	76.2	10.5	5.92	17	3.29	9.21	13		0.15	1.38		5.17	3	15.50	0.00	0.00	0.00	15.50
5	Other Lawn & Garden Equipment	0.51	0	76.2	10.5	5.92	17	33.33	39.25	3		0.22	[illegible]		0.39	3	1.16	0.00	0.00	0.00	1.16
6	Aircraft Support Equipment	24.48	4.4	68.9	12.5	5.83	3.6	0.15	5.97	48		0.08	[illegible]		24.48	3	73.44	0.00	0.00	0.00	73.44
8	Terminal Tractors	5.71	4.4	68.9	12.5	5.83	3.6	0.63	6.46	82		0.08	0.52		5.71	3	17.13	0.00	0.00	0.00	17.13
9	All Terrain Vehicles (ATVs)	2.00	0	76.2	10.5	5.92	17	8.50	14.42	20	0.72	0.15	2.16	[illegible]	2.00	3	6.00	0.00	0.00	0.00	6.00
9	Minibikes	0.50	0	76.2	10.5	5.92	17	34.00	39.92	4	0.62	0.22	8.74	[illegible]	0.50	3	1.50	0.00	0.00	0.00	1.50
9	Off-Road Motorcycles	2.00	0	76.2	10.5	5.92	17	8.50	14.42	36	0.76	0.08	1.16	[illegible]	2.00	3	6.00	0.00	0.00	0.00	6.00
9	Golf Carts	6.00	0	76.2	10.5	5.92	17	2.83	8.75	9	0.46	0.15	1.31	[illegible]	6.00	3	18.00	0.00	0.00	0.00	18.00
	Snowmobiles	8.08	0	60.3	13.9	6.16	17	2.10	8.27	26		0.08	0.67		8.08	3	24.24	0.00	0.00	0.00	24.24
9,10	Specialty Vehicles Carts	6.00	0	60.3	13.9	6.16	17	2.83	9.00	9	0.58	0.15	1.35	[illegible]	6.00	3	18.00	0.00	0.00	0.00	18.00
6,11	Vessels w/Inboard Engines	86.70	8.8	76.2	10.5	5.08	3.6	0.04	5.12	170		0.08	0.41		86.70	3	260.10	0.00	0.00	0.00	260.10
11,12	Vessels w/Outboard Engines	6.00	0	76.2	10.5	5.92	17	2.83	8.75	50		0.08	0.71		6.00	0	0.00	0.00	0.00	0.00	0.00
11,13	Sailboat Auxiliary Inboard Engines	6.00	0	76.2	10.5	5.92	17	2.83	8.75	12		0.15	1.31		6.00	3	18.00	0.00	0.00	0.00	18.00
11-13	Sailboat Auxiliary Outboard Engin	6.00	0	76.2	10.5	5.92	17	2.83	8.75	7		0.22	1.92		6.00	0	0.00	0.00	0.00	0.00	0.00
11,14	Vessels w/Sterndrive Engines	21.00	8.8	76.2	10.5	5.08	3.6	0.17	5.25	170		0.08	0.42		21.00	3	63.00	0.00	0.00	0.00	63.00
15	Generator Sets <50 HP	1.02	0	68.9	12.5	6.24	17	16.66	22.90	11		0.15	[illegible]		1.02	3	3.06	0.00	0.00	0.00	3.06
	Pumps <50 HP	0.75	0	68.9	12.5	6.24	17	22.67	28.91	7		0.22	[illegible]		0.75	3	2.25	0.00	0.00	0.00	2.25
16	Air Compressors <50 HP	1.13	0	68.9	12.5	6.24	17	15.11	21.36	8		0.15	[illegible]		1.13	3	3.39	0.00	0.00	0.00	3.39
17	Gas Compressors <50 HP	All LPG or CNG																			
	Welders <50 HP	3.25	0	68.9	12.5	6.24	17	5.23	11.48	19		0.15	1.72		3.25	3	9.75	0.00	0.00	0.00	9.75
18	Pressure Washers <50 HP	0.75	0	68.9	12.5	6.24	17	22.67	28.91	7		0.22	[illegible]		0.75	3	2.25	0.00	0.00	0.00	2.25
6	Aerial Lifts	18.36	4.4	68.9	12.5	5.83	3.6	0.20	6.02	38		0.08	[illegible]		18.36	3	55.08	0.00	0.00	0.00	55.08
	Forklifts	18.00	4.4	68.9	12.5	5.83	3.6	0.20	6.03	62		0.08	[illegible]		18.00	3	54.00	0.00	0.00	0.00	54.00
6	Sweepers/Scrubbers	19.89	4.4	68.9	12.5	5.83	3.6	0.18	6.01	38		0.08	[illegible]		19.89	3	59.67	0.00	0.00	0.00	59.67
6	Other General Industrial Equipme	9.69	4.4	68.9	12.5	5.83	3.6	0.37	6.20	19		0.15	[illegible]		9.69	3	29.07	0.00	0.00	0.00	29.07
6	Other Material Handling Equipmer	26.01	4.4	68.9	12.5	5.83	3.6	0.14	5.97	51		0.08	[illegible]		26.01	3	78.03	0.00	0.00	0.00	78.03
6	Asphalt Pavers	15.81	8.8	68.9	12.5	5.41	3.6	0.23	5.64	51		0.08	[illegible]		15.81	3	47.43	0.00	0.00	0.00	47.43
19	Tampers/Rammers	0.94	0	68.9	12.5	6.24	17	18.13	24.38	4		0.22	5.36		0.94	3	2.81	0.00	0.00	0.00	2.81
	Plate Compactors	0.94	0	68.9	12.5	6.24	17	18.13	24.38	5		0.22	5.36		0.94	3	2.81	0.00	0.00	0.00	2.81
20	Concrete Pavers	All Diesel													All Diesel						
	Rollers	3.00	8.8	76.2	10.5	5.08	17	5.67	10.75	17		0.15	1.61		3.00	3	9.00	0.00	0.00	0.00	9.00
20	Scrapers	All Diesel													All Diesel						
21	Paving Equipment	1.00	0	76.2	10.5	5.92	17	17.00	22.92	7		0.22	[illegible]		1.00	3	3.00	0.00	0.00	0.00	3.00
22	Surfacing Equipment	1.00	8.8	76.2	10.5	5.08	17	17.00	22.08	8		0.22	[illegible]		1.00	3	3.00	0.00	0.00	0.00	3.00
23	Signal Boards	1.02	0	76.2	10.5	5.92	17	16.65	22.57	8		0.22	[illegible]		1.02	3	3.06	0.00	0.00	0.00	3.06
	Trenchers	2.56	8.8	76.2	10.5	5.08	17	6.63	11.72	27		0.08	0.94		2.56	3	7.68	0.00	0.00	0.00	7.68
6	Bore/Drill Rigs	27.54	8.8	76.2	10.5	5.08	3.6	0.13	5.22	54		0.08	0.42		27.54	3	82.62	0.00	0.00	0.00	82.62
	Excavators	40.80	8.8	76.2	10.5	5.08	3.6	0.09	5.17	80		0.08	0.42		40.80	3	122.40	0.00	0.00	0.00	122.40
	Concrete/Industrial Saws	1.38	0	76.2	10.5	5.92	17	12.36	18.28	13		0.15	2.74		1.38	3	4.13	0.00	0.00	0.00	4.13
	Cement and Mortar Mixers	1.25	8.8	76.2	10.5	5.08	17	13.60	18.68	7		0.22	[illegible]		1.25	3	3.75	0.00	0.00	0.00	3.75
6	Cranes	28.05	8.8	76.2	10.5	5.08	3.6	0.13	5.21	55		0.08	0.42		28.05	3	84.15	0.00	0.00	0.00	84.15
20	Graders	All Diesel													All Diesel						
20	Off-Highway Trucks	All Diesel													All Diesel						
6	Crushing/Proc. Equipment	30.60	8.8	76.2	10.5	5.08	3.6	0.12	5.20	60		0.08	0.42		30.60	3	91.80	0.00	0.00	0.00	91.80
6	Rough Terrain Forklifts	44.88	8.8	76.2	10.5	5.08	3.6	0.08	5.16	88		0.08	0.42		44.88	3	134.64	0.00	0.00	0.00	134.64
6	Rubber Tired Loaders	34.17	8.8	76.2	10.5	5.08	3.6	0.11	5.19	67		0.08	0.42		34.17	3	102.51	0.00	0.00	0.00	102.51
20	Rubber Tired Dozers	All Diesel													All Diesel						
6	Tractors/Loaders/Backhoes	32.13	8.8	76.2	10.5	5.08	3.6	0.11	5.20	63		0.08	0.42		32.13	3	96.39	0.00	0.00	0.00	96.39

Table I-15. Refueling and Evaporative Emission Factors - Gasoline (Cont'd)

Manufacturer Data	Average Gas Tank Volume		Equipment List	Average Gas Tank Volume	dT (Deg. F	Td (Deg. F)	RVP	REFUELING EMISSIONS g deplcd per gal. (g/gal)	g spilled per rfling (g/rfl)	g spilled per gal (g/gal)	Refuel. Subtot. (g/gal)	Mean HP	Load Factor	BSFC (gal/hp-hr)	Final refuel. (g/hp-hr)	Final refuel. (g/hr)	EVAPORATIVE EMISSIONS Average Gas Tank Volume	Diurnal E.F. (g/gal/d	subtotal (g/day)	Hot Soak	Rest. Loss	Run. Loss	Total Evap (g/day)
		20	Crawler Tractors	All Diesel													All Diesel						
Skid Steer Loaders	8.34		Skid Steer Loaders	8.34	8.8	76.2	10.5	5.08	3.6	0.43	5.52	33		0.08	0.44		8.34	3	25.01	0.00	0.00	0.00	25.01
		20	Off-Highway Tractors	All Diesel													All Diesel						
		24	Dumpers/Tenders	3.00	0	76.2	10.5	5.92	17	5.67	11.59	9		0.15	1.74		3.00	3	9.00	0.00	0.00	0.00	9.00
		6	Other Construction Equipment	76.50	8.8	76.2	10.5	5.08	3.6	0.05	5.13	150		0.08	0.41		76.50	3	229.50	0.00	0.00	0.00	229.50
Concrete Pumps	1.25																						
		25	2-Wheel Tractors	2.67	0	76.2	10.5	5.92	17	6.37	12.29	7		0.22	2.70		2.38	3	7.13	0.00	0.00	0.00	7.13
		6	Agricultural Tractors	44.37	8.8	76.2	10.5	5.08	3.6	0.08	5.17	87		0.08	0.41		44.37	3	133.11	0.00	0.00	0.00	133.11
		25	Agricultural Mowers	2.67	0	76.2	10.5	5.92	17	6.37	12.29	11		0.15	1.84		2.67	3	8.01	0.00	0.00	0.00	8.01
		6	Combines	66.81	8.8	76.2	10.5	5.08	3.6	0.05	5.14	131		0.08	0.41		66.81	3	200.43	0.00	0.00	0.00	200.43
Crop/Turf Sprayers	1.50		Sprayers	1.50	0	76.2	10.5	5.92	17	11.33	17.25	24		0.08	1.38		1.50	3	4.50	0.00	0.00	0.00	4.50
26 Fertilizer Spreaders	0.50																						
		20	Balers	All Diesel													All Diesel						
Tillers >5 HP	1.21		Tillers >5 HP	1.21	0	76.2	10.5	5.92	17	14.07	19.99	7		0.22	4.40		1.21	3	3.63	0.00	0.00	0.00	3.63
		6	Swathers	54.06	8.8	76.2	10.5	5.08	3.6	0.07	5.15	106		0.08	0.41		54.06	3	162.18	0.00	0.00	0.00	162.18
		27	Hydro Power Units	5.00	0	76.2	10.5	5.92	17	3.40	9.32	14		0.15	1.40		5.00	3	15.00	0.00	0.00	0.00	15.00
		6	Other Agricultural Equipment	28.05	8.8	76.2	10.5	5.08	3.6	0.13	5.21	55		0.08	0.42		28.05	3	84.15	0.00	0.00	0.00	84.15
Chain Saws >5 HP	0.22		Chainsaws >4 HP	0.22	0	76.2	10.5	5.92	17	77.27	83.19	6		0.22	18.30		0.22	3	0.66	0.00	0.00	0.00	0.66
Shredders >5 HP	1.00		Shredders >5 HP	1.00	0	76.2	10.5	5.92	17	17.00	22.92	8		0.22	5.04		1.00	3	3.00	0.00	0.00	0.00	3.00
		20	Skidders	All Diesel													All Diesel						
		20	Fellers/Bunchers	All Diesel													All Diesel						

These notes are intended to provide a brief summary of important assumptions. See text for more detailed explanations.

1 Edge, hedge, string trimmers averaged to get "Trimmers/Edgers/Brush Cutters" category
2 Consumer and commercial lawn mower tank volumes were population and usage weighted for refueling emissions and population weighted for evaporative emissions.
3 For evap emissions, walk behind and hand held blower fuel tank volumes were population weighted to get "Leaf Blowers/Vacuums". For Refueling emissions, walk behind and hand held blower fuel tank volumes were population, HP, and usage weighted. Populations were supplied by PPEMA (assume "backpack" blowers are equivalent to "walk behind") and usage was assumed similar to commercial and consumer lawn mowers.
4 Lawn and garden tractor fuel tank volumes were population and usage weighted for refueling emissions and population weighted for evaporative emissions.
5 Assumed equal to walk behind lawn mowers
6 Fuel tank volumes found using regression analysis.
7 Hydro-Seeders/Mulchers were not included in the "Commercial Turf Equipment" category because there is no way to adequately weigh their impact. In addition, their population is small relative to wide area mowers.
8 Aircraft and baggage towing tractor gasoline fuel tank volumes were assumed equal to corresponding diesel fuel tank volumes.
9 Refueling emissions expressed in g/hr for these equipment types.
10 "Specialty Vehicles/Carts" assumed to have same tank volumes as "Golf Carts"
11 Refueling emissions expressed in g/gal for these equipment types.
12 These equipment have unvented fuel tanks and therefore emit no diurnal emissions.
13 "Sailboat Auxiliary Engines" assumed to have fuel tank volumes of 6 gallons.
14 "Vessels w/Sterndrive Engines" assumed to have fuel tank volumes of 21 gal.
15 Fuel tank volumes from portable and small generator sets were averaged to get "Generator Sets <50HP"
16 "Air Compressors" are assumed to be equivalent to Small Compressors.
17 This equipment is LPG or CNG powered only
18 "Pressure Washers" are assumed to be equivalent to "Pumps".
19 "Tampers/Rammers" are assumed equivalent to "Plate Compactors"
20 This equipment is diesel powered only.
21 "Paving Equipment" assumed equivalent to "Vibrators/Finishers"
22 "Surfacing Equipment" assumed equivalent to "Paving Equipment"
23 "Signal Boards" are assumed equivalent to "Generator Sets <50HP".
24 "Dumpers/Tenders" are assumed to have gasoline fuel tank volumes of 3 gal.
25 These equipment are assumed equivalent to "Lawn and Garden Tractors"
26 Fertilizer spreaders were not included in "Sprayers" because there was no means
27 "Hydro Power Units" assumed to have 5 gallon gasoline tanks.

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Table I-16. Refueling and Evaporative Emission Factors - Diesel

Manufacturer's Data	Average Gas Tank Volume		Equipment List	REFUELING EMISSIONS Average Gas Tank Volume	g deplcd per gal. (g/gal)	Mean HP	Load Factor	BSFC (gal/hp-hr)	Final refuel. (g/hp-hr)	Final refuel. (g/hr)	EVAPORATIVE EMISSION Diurnal E.F.	Hot Soak	Rest. Loss	Run. Loss	Total Evap (g/day)
		2	Trimmers/Edgers/Brush Cutters	All Gas											
		2	Lawn Mowers	All Gas											
		2	Leaf Blowers/Vacuums	All Gas											
		1	Rear Engine Riding Mowers	8.67	0.040	17		0.120	[illegible]		0.00	0.00	0.00	0.00	0.00
		2	Front Mowers	All Gas											
		2	Chainsaws <4 HP	All Gas											
		2	Shredders <5 HP	All Gas											
		2	Tillers <5 HP	All Gas											
Lawn Tractors	4.07	1	Lawn & Garden Tractors	8.16	0.040	16		0.120	[illegible]		0.00	0.00	0.00	0.00	0.00
Garden Tractors	4.83														
		1	Wood Splitters	29.58	0.040	58		0.064	[illegible]		0.00	0.00	0.00	0.00	0.00
		2	Snowblowers	All Gas											
		1	Chippers/Stump Grinders	50.48	0.040	99		0.064	[illegible]		0.00	0.00	0.00	0.00	0.00
		1	Commercial Turf Equipment	All Gas	0.040	24		0.064			0.00	0.00	0.00	0.00	0.00
		1	Other Lawn & Garden Equipment	9.18	0.040	18		0.120	[illegible]		0.00	0.00	0.00	0.00	0.00
		3	Aircraft Support Equipment	69.87	0.040	137		0.064	[illegible]		0.00	0.00	0.00	0.00	0.00
Aircraft Towing Tractors	7.70		Terminal Tractors	5.71	0.040	96		0.064	[illegible]		0.00	0.00	0.00	0.00	0.00
Baggage Towing Tractors	5.30														
		2,4	All Terrain Vehicles (ATVs)	All Gas											
		2,4	Minibikes	All Gas											
		2,4	Off-Road Motorcycles	All Gas											
		2,4	Golf Carts	All Gas											
		2	Snowmobiles	All Gas											
		4	Specialty Vehicles Carts	108.59	0.040	209	0.65	0.064	0.0026	[illegible]	0.00	0.00	0.00	0.00	0.00
		1,5	Vessels w/Inboard Engines	120.36	[illegible]	236		0.064	0.0026		0.00	0.00	0.00	0.00	0.00
Outboard Motors	6.00	2,5	Vessels w/Outboard Engines	All Gas											
		1,5	Sailboat Auxiliary Inboard Engines	15.30	[illegible]	30		0.064	0.0026		0.00	0.00	0.00	0.00	0.00
		5,6	Sailboat Auxiliary Outboard Engines	6.00	[illegible]	7		0.175	0.0070		0.00	0.00	0.00	0.00	0.00
		2,5	Vessels w/Sterndrive Engines	All Gas											
		1	Generator Sets <50 HP	11.22	0.040	22		0.064	[illegible]		0.00	0.00	0.00	0.00	0.00
		1	Pumps <50 HP	11.73	0.040	23		0.064	[illegible]		0.00	0.00	0.00	0.00	0.00
		1	Air Compressors <50 HP	18.67	0.040	37		0.064	[illegible]		0.00	0.00	0.00	0.00	0.00
		7	Gas Compressors < 50 HP	All LPG or CNG											
		1	Welders <50 HP	17.86	0.040	35		0.064	[illegible]		0.00	0.00	0.00	0.00	0.00
		1	Pressure Washers <50 HP	10.71	0.040	21		0.064	[illegible]		0.00	0.00	0.00	0.00	0.00
		1	Aerial Lifts	21.95	0.040	43		0.064	[illegible]		0.00	0.00	0.00	0.00	0.00
Forklifts	18.00	1	Forklifts	42.33	0.040	83		0.064	[illegible]		0.00	0.00	0.00	0.00	0.00
		1	Sweepers/Scrubbers	49.47	0.040	97		0.064	[illegible]		0.00	0.00	0.00	0.00	0.00
		1	Other General Industrial Equipment	54.67	0.040	107		0.064	[illegible]		0.00	0.00	0.00	0.00	0.00
		1	Other Material Handling Equipment	56.61	0.040	111		0.064	[illegible]		0.00	0.00	0.00	0.00	0.00
Asphalt Pavers	36.00	1	Asphalt Pavers	46.41	0.040	91		0.064	[illegible]		0.00	0.00	0.00	0.00	0.00
		2	Tampers/Rammers	All Gas											
		8	Plate Compactors	2.00	0.040	8		0.175	[illegible]		0.00	0.00	0.00	0.00	0.00
		1	Concrete Pavers	66.30	0.040	130		0.064	[illegible]		0.00				0.00
Compactors	39.00														
Rollers	16.00	1	Rollers	50.48	0.040	99		0.064	[illegible]		0.00	0.00	0.00	0.00	0.00
Vibratory Roller Compactors	39.00														
Scrapers	150.50	1	Scrapers	158.61	0.040	311		0.064	[illegible]		0.00				0.00
Pavement Profilers	201.00														
Soil Stabilizers	110.00	1	Paving Equipment	50.48	0.040	99		0.064	[illegible]		0.00	0.00	0.00	0.00	0.00
Road Reclaimers	110.00														
		2	Surfacing Equipment	All Gas											
		9	Signal Boards	11.22	0.040	6		0.175	[illegible]		0.00	0.00	0.00	0.00	0.00
		1	Trenchers	30.60	0.040	60		0.064	[illegible]		0.00	0.00	0.00	0.00	0.00
		1	Bore/Drill Rigs	106.56	0.040	209		0.064	[illegible]		0.00	0.00	0.00	0.00	0.00
Excavators	95.00	1	Excavators	93.33	0.040	183		0.064	[illegible]		0.00	0.00	0.00	0.00	0.00
		1	Concrete/Industrial Saws	28.58	0.040	56		0.064	[illegible]		0.00	0.00	0.00	0.00	0.00
		10	Cement and Mortar Mixers	3.00	0.040	11		0.120	[illegible]		0.00	0.00	0.00	0.00	0.00
		1	Cranes	98.94	0.040	194		0.064	[illegible]		0.00	0.00	0.00	0.00	0.00
Motor Graders	80.50	1	Graders	87.72	0.040	172		0.064	[illegible]		0.00	0.00	0.00	0.00	0.00
Off-Highway Truckers	281.00	1	Off-Highway Trucks	246.30	0.040	489		0.064	[illegible]		0.00	0.00	0.00	0.00	0.00
		1	Crushing/Proc. Equipment	64.77	0.040	127		0.064	[illegible]		0.00	0.00	0.00	0.00	0.00
		1	Rough Terrain Forklifts	47.43	0.040	93		0.064	[illegible]		0.00	0.00	0.00	0.00	0.00
Wheel Loaders	73.00	1	Rubber Tired Loaders	80.58	0.040	158		0.064	[illegible]		0.00	0.00	0.00	0.00	0.00
Dozer Tractors	154.00	1	Rubber Tired Dozers	181.56	0.040	356		0.064	[illegible]		0.00				0.00
Back-hoe Loaders	28.50	1	Tractors/Loaders/Backhoes	38.27	0.040	77		0.064	[illegible]		0.00	0.00	0.00	0.00	0.00
Tractors	18.00														
Crawl Dozers	103.50	1	Crawler Tractors	80.07	0.040	157		0.064	[illegible]		0.00				0.00
Crawler Loaders	58.00														
Skid Steer Loaders	14.46	1	Skid Steer Loaders	21.42	0.040	42		0.064	[illegible]		0.00	0.00	0.00	0.00	0.00
		1	Off-Highway Tractors	109.14	0.040	214		0.064	[illegible]		0.00				0.00
		1	Dumpers/Tenders	11.73	0.040	23		0.064	0.0026		0.00	0.00	0.00	0.00	0.00
		1	Other Construction Equipment	82.11	0.040	161		0.064	0.0026		0.00	0.00	0.00	0.00	0.00
		2	2-Wheel Tractors	All Gas											
		1	Agricultural Tractors	49.98	0.040	98		0.064	0.0026		0.00	0.00	0.00	0.00	0.00
		2	Agricultural Mowers	All Gas											
Combines-Harvesters	115.00	1	Combines	77.52	0.040	152		0.064	0.0026		0.00	0.00	0.00	0.00	0.00
		1	Sprayers	46.92	0.040	92		0.064	0.0026		0.00	0.00	0.00	0.00	0.00
Balers	28.00	1	Balers	37.74	0.040	74		0.064	0.0026		0.00	0.00	0.00	0.00	0.00
Bale Wagons	56.00														
		11	Tillers >5 HP	2.00	0.040	7		0.175	0.0070		0.00	0.00	0.00	0.00	0.00
		1	Swathers	40.29	0.040	79		0.064	0.0026		0.00	0.00	0.00	0.00	0.00
			Hydro Power Units	17.85	0.040	35		0.064	0.0026		0.00	0.00	0.00	0.00	0.00
		1	Other Agricultural Equipment	29.07	0.040	57		0.064	0.0026		0.00	0.00	0.00	0.00	0.00
		2	Chainsaws >4 HP	All Gas											
		2	Shredders >5 HP	All Gas											
Log Skidders	42.50	1	Skidders	76.50	0.040	150		0.064	0.0026		0.00	0.00	0.00	0.00	0.00
Feller-Bunchers	144.00	12	Fellers/Bunchers	144.00	0.040	183		0.064	0.0026		0.00	0.00	0.00	0.00	0.00
Delimbers >5 HP	70.00														

Note that all fuel tank volumes are generated based on the regression line described in the text except where indicated below.

1 Fuel tank volumes found using regression analysis.

2 This equipment is gasoline powered only.

3 Sales weighted average of aircraft and baggage tow tractor tank volumes used.

4 Refueling emissions expressed in g/hr for these equipment types.

5 Refueling emissions expressed in g/gal for these equipment.

6 "Sailboat Auxiliary Outboard Engines" assumed to have 6 gallon tanks.

7 This equipment is LPG or CNG powered only

8 "Plate Compactors" assumed to have 2 gallon fuel tanks.

9 "Signal Boards" are assumed equivalent to "Generator Sets <50HP".

10 "Cement and Mortar Mixers" assumed to have 3 gallon tanks.

11 "Tillers >5 HP" assumed to have 2 gallon tanks.

12 "Feller/Bunchers" fuel tank volume taken from the average of John Deere product literature values

Table I-17. Fuel Tank vs Net Engine HP Regression

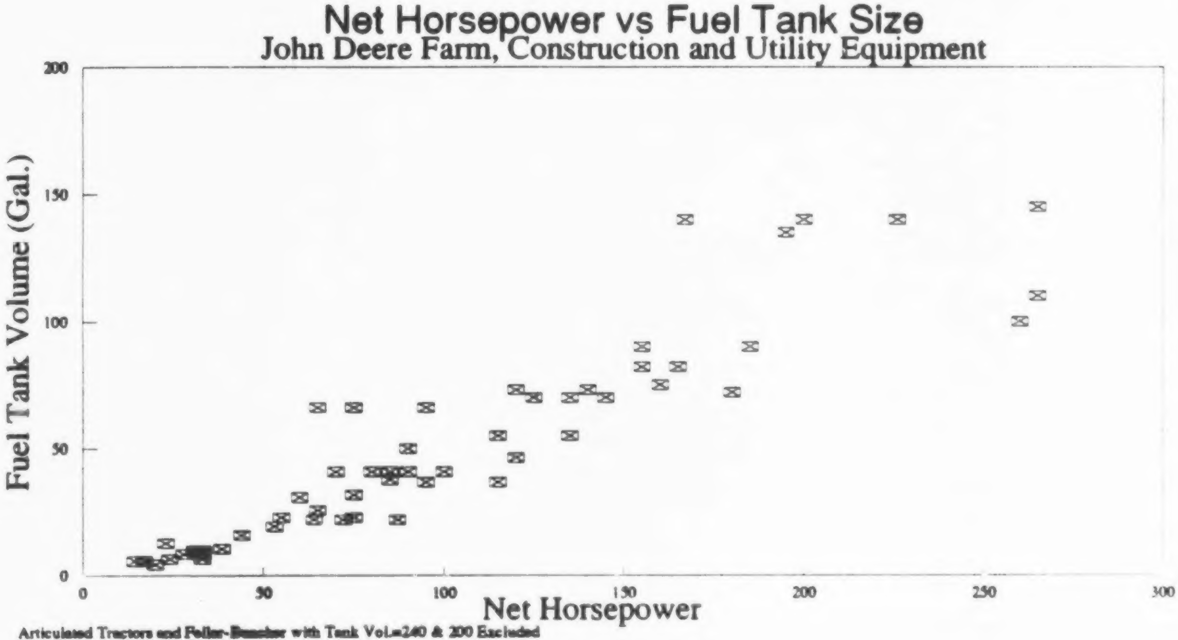
Fuel tank sizes of various John Deere farm, construction and utility engines regressed against gross and net engine power, and displacement. All values taken from 1989-90 sales brochures.

Engine	Application	Model	Type	Fuel	Net HP	Gallons
3TNA72UJ	Tractor (Compact)	755	Utility	d	20.0	4.4
Yanmar 3TNA78-RJB	Excavator (Compact)	15	Utility	d	14.5	5.8
Yanmar 3TN66	Skid-Steer Loader	375	Utility	g?	17.0	6.0
3TN84RJ	Tractor (Compact)	955	Utility	d	33.0	6.6
3TN75RJ	Tractor (Compact)	855	Utility	d	24.0	6.6
	Tractor (Compact)	970	Utility	d	33.0	8.5
	Tractor (Compact)	870	Utility	d	28.0	8.5
Continental TM13	Skid-Steer Loader	570	Utility	g	31.0	10.0
Yanmar 3TNA82	Skid-Steer Loader	575	Utility	d	33.0	10.0
	Tractor (Compact)	1070	Utility	d	38.5	10.6
Yanmar 3TNA72-UJB	Excavator (Compact)	25	Utility	d	23.0	12.9
Yanmar 4TNA82	Skid-Steer Loader	675B	Utility	d	44.0	16.1
J.D. 3-179D	Tractor (General Purpose)	2155	Utility	d	53.0	19.5
J.D. 4-239D	Tractor (General Purpose)	2555	Utility	d	72.0	22.2
J.D. 4-239D	Tractor (General Purpose)	2355	Utility	d	64.0	22.2
J.D. 4-239T	Tractor (General Purpose)	2755	Utility	d	87.0	22.2
4239D	Backhoe Loader	210C	Utility	d	55.0	23.0
4276D	Backhoe Loader	410C	Utility	d	75.0	23.0
4239D	Landscape Loader	210C	Utility	d	55.0	23.0
4239D	Backhoe Loader	310C	Utility	d	65.0	26.0
4239D	Crawler Dozer	400G	Forest	d	60.0	31.0
4276D	Log Loader	344E	Forest	d	75.0	32.0
4276D	Wheel Loader	344E	Const	d	75.0	32.0
6359T	Backhoe Loader	710C	Utility	d	115.0	37.0
4276T	Log Loader	444E	Forest	d	95.0	37.0
4276T	Wheel Loader	444E	Const	d	95.0	37.0
4276T	Backhoe Loader	510C	Utility	d	85.0	38.0
4276T	Crawler Dozer	650G	Forest	d	90.0	41.0
4276T	Crawler Dozer	550G	Forest	d	80.0	41.0
4276D	Crawler Dozer	450G	Forest	d	70.0	41.0
4276T	Crawler Dozer	650G	Const	d	90.0	41.0
4276D	Crawler Loader	455G	Forest	d	70.0	41.0
4276T	Crawler Loader	555G	Forest	d	90.0	41.0
4276T	Skidder	440D	Forest	d	85.0	41.0
4276T	Skidder	540D, 548D/7	Forest	d	100.0	41.0
6414T	Skidder	640D	Forest	d	120.0	46.5
6414T	Skidder (grapple)	648D/7413	Forest	d	120.0	46.5
6359D	Graders	570B	Const	d	90.0	50.0
6359T	Log Loader	544E	Forest	d	115.0	55.0
6414T	Log Loader	624E	Forest	d	135.0	55.0
6414T	Wheel Loader	624E	Const	d	135.0	55.0
6359T	Wheel Loader	544E	Const	d	115.0	55.0
4239D	Excavator	290D	Utility	d	65.0	66.0
4276T	Excavators	490D	Const	d	75.0	66.0
4276T	Excavators	495D, 590D, !	Const	d	95.0	66.0
4276D	Feller-Buncher	493D	Forest	d	75.0	66.0
6414T	Delimber	693D	Forest	d	125.0	70.0
6414T	Excavators	690D, 690D-L	Const	d	125.0	70.0
6414A	Feller-Buncher	643	Forest	d	145.0	70.0
6414T	Graders	670B, 672B	Const	d	135.0	70.0
6466A	Scrapers	762B	Const	d	180.0	72.0
6414T	Crawler Dozer	750B	Const	d	120.0	73.0
6414T	Crawler Dozer	750B	Const	d	140.0	73.0
6414T	Crawler Loader	665B	Const	d	120.0	73.0
6414T	Crawler Loader	755B	Const	d	140.0	73.0
6076T	Log Loader	644E	Forest	d	160.0	75.0
6076T	Wheel Loader	644E	Const	d	160.0	75.0
6466A	Crawler Dozer	850B	Const	d	165.0	82.0
6466A	Excavators	790D	Const	d	155.0	82.0
6466A	Graders	770B-H, 772E	Const	d	185.0	90.0
6466T	Graders	770B, 772B	Const	d	155.0	90.0
8955T	Wheel Loader	844	Const	d	260.0	100.0
6619A	Scrapers	862B	Const	d	265.0	110.0

Table I-17. Fuel Tank vs Net Engine HP Regression (Cont'd)

6466A	Excavators	892D-LC	Const	d	195.0	135.0
	Combine	9500	Farming	d	200.0	140.0
	Combine	9600	Farming	d	226.0	140.0
	Combine	9400	Farming	d	167.0	140.0
6619A	Excavators	992D-LC	Const	d	265.0	145.0
6414A	Feller-Buncher	693D	Forest	d	125.0	200.0 (not included)
	Tractor (Articulated)	8560	Farming	d	235.0	220.0 (not included)
	Tractor (Articulated)	8760	Farming	d	300.0	220.0 (not included)
	Tractor (Articulated)	8960	Farming	d	370.0	220.0 (not included)
6466A	Feller-Buncher	793D	Forest	d	155.0	240.0 (not included)

Regression of Net Power vs Fuel Tank Size		
Constant		0
Std Err of Y Est		15.3
R Squared		0.82
No. of Observations		68
Degrees of Freedom		67
X Coefficient(s)	0.510631	
Std Err of Coef.	0.015467	



Articulated Tractors and Feller-Buncher with Tank Vol.=240 & 200 Excluded
John Deere equipment only

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Appendix J. Additional Data Submissions

The following manufacturers, state agencies, and manufacturer associations submitted data to EPA for analysis and review.

Briggs & Stratton
California Air Resources Board
Caterpillar
Engine Manufacturers Association
Equipment Manufacturers Institute
Ford/New Holland
Ford
Gardenway
Homelite
Industrial Truck Association
International Snowmobile Industry Association
John Deere
Kohler
Lawn-Boy
Manufacturers of Emission Controls Association
McCulloch
Motorcycle Industry Council, Inc.
Murray
National Marine Manufacturers Association
Onan
Outdoor Power Equipment Institute, Inc.
Portable Power Equipment Manufacturers Association
Tecumseh Products Company
Weedeaters

Appendix K. Adjustments to Data in Developing Inventory A

In developing Inventory A, EPA made several adjustments to annual hours of use, load factor, population data, and the emissions inventory methodology for recreational marine equipment that are not reflected in the final reports from EPA contractors. These adjustments are detailed below.

1. Annual Hours of Use

Annual hours of use data provided to EPA from the PSR data base were largely based on the assumption that the use of various equipment types is either consumer or commercial. In order to adjust for equipment types with a mixture of consumer and commercial use, EPA adjusted the data by multiplying the regional hours of use reported by the contractor by factors based on data submitted to EPA by OPEI,[1] PPEMA,[2] and CARB:[3]

Equipment Type	Adjustment Factor
Lawnmowers (4-stroke)	1.75 (OPEI)
Lawnmowers (2-stroke)	2.17 (OPEI)
Tillers	1.54 (OPEI)
Trimmers/edgers/brush cutters	1.8 (PPEMA)
Leaf Blowers/vacuums	2.5 (PPEMA)
Snowblowers	1.5 (CARB)

These factors were calculated using the following general equation:

Adjustment Factor = (% consumer) x (consumer hrs) + (% commercial) x (commercial hrs)

In the case of trimmers/edgers/brush cutters, it was necessary to also weight by population the annual hours of use for string and hedge trimmers, for which PPEMA submitted separate estimates. Similarly, the value computed for leaf blowers/vacuums incorporates both handheld and backpack versions. Detailed information used to derive these adjustments are contained in Appendix N, Part 2.

2. Load Factors

Load factor data provided to EPA from the PSR data base were in some cases too high and in others too low. To correct the data, EPA substituted load factors determined by CARB for the entire lawn and garden equipment category,[4] and data supplied by EMI for crawler tractors and rubber tired loaders.[5]

Equipment Type	Load Factor (%)
Leaf blowers/vacuums (2-stroke)	50
Leaf blowers/vacuums (4-stroke)	36
Trimmers/edgers/Brush cutters (2-stroke)	50
Trimmers/edgers/Brush cutters (4-stroke)	36
Chain saws > 4 hp	50
Chain saws < 4 hp	50
Lawnmowers	36
Rear engine riding mowers	38
Lawn and garden tractors	50*
Front mowers	50
Shredders < 5 hp	36
Tillers < 5 hp	40
Snowblowers	35
Commercial turf equipment	50
Other lawn and garden equipment	50
Crawler tractors	58
Rubber tired loaders	54

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* Based on CARB data for consumer and commercial riding mowers and garden tractors, which were weighted by population x hours/yr x rated horsepower.

3. Populations--Chain Saws

In constructing Inventory A, EPA relied on a methodology developed by PPEMA[6] for allocating chain saw populations to the local level. The methodology developed by EEA uses single family housing units (SFHUs) and SIC 078 (landscaping and horticultural services) employment. While this methodology is appropriate for most types of lawn and garden equipment, chain saws are not generally used in major urbanized areas except by horticultural services. One of the four models proposed by PPEMA is based on urban population [human] outside major urbanized areas, rural area population, and SIC 078 employment, which is more appropriate for allocating chain saw use. The national chain saw population estimates reported by EEA were disaggregated to the local level using the local allocations developed with this methodology for Inventory B, as follows:

$$N_A \text{ local} = \frac{N_B \text{ local}}{N_B \text{ national}} \times N_A \text{ national}$$

where N refers to the number of chain saws (all sizes) and A and B refer to Inventories A and B.

4. Populations--Agricultural Equipment

For Inventory A, regional agricultural equipment populations were determined by multiplying PSR national population estimates by the ratio of local over national census data.

Census data exists for some types of agricultural equipment at the local level. However, census counts do not differentiate between equipment that is inoperative or seldom used and equipment used for agricultural activity. National population estimates from the PSR data base are better estimates of equipment used regularly in agricultural activity than the census counts. However, the census counts are accurate indicators of local distribution of the equipment. Thus, the census counts were used as indications to disaggregate the PSR national population estimates to the local level.

5. Populations--Snowmobiles

As recommended by ISIA, EPA assumed that all snowmobiles use 2-stroke gasoline engines, despite the fact that EEA reported a very small number of 4-strokes.

6. Recreational Marine Equipment Emissions Inventory Methodology

Population -- Local boat registration data were used to establish the number of boats of each equipment type in each nonattainment area. However, two adjustments to this information were needed for inventory purposes. The first adjustment was to turn the number of boats into the number of engines. This was necessary to match the horsepower and hours of use estimates, which were derived per engine. The methodology used to calculate the number of engines per boat for this study was developed by EEA and provided to EPA.

The second adjustment was to estimate the number of engines actually used in the nonattainment areas. Unlike most of the equipment contained in this study recreational boats are frequently transported long distances, such that where they are used may be different from where they are owned. Survey results submitted by NMMA for eight nonattainment areas were used as the basis for these adjustments. The survey was conducted for NMMA by Irwin Broh and Associates, Inc. (IB&A).[7] Questionnaires were mailed at random to registered boat owners within and in counties lying within a 50-mile belt of the following nonattainment areas:

Baltimore, MD
Boston, MA
Chicago, IL
Denver, CO
Hartford, CT
Houston, TX
Milwaukee, WI
Seattle, WA

The questionnaire asked a wide variety of questions about the kind of boat(s) owned; engine number, type, and size; amount, location, and time of usage; and fuel used. The information from the survey was used by EPA in the following formula to calculate the umber of engines used in the nonattainment area:

$$EU = ER\left[\frac{\text{Fuel used in n/a}^{*}\text{ area}}{\text{Fuel used by boats registered in n/a area}} + \%\text{ use from 0-1 mile offshore}\right]$$

*n/a = nonattainment

where:

EU = engines used in nonattainment area
ER = Engines registered in nonattainment area
Fuel used in n/a area = the sum of the reported amount of fuel consumed inside the nonattainment area by boats registered inside the nonattainment area, plus the fuel consumed within the nonattainment area by boats registered outside the nonattainment area
Fuel used by boats registered in the n/a area = The total reported amount of fuel consumed by boats registered inside the nonattainment area without regard to where the fuel was consumed.
% use from 0-1 mile offshore = The survey reported offshore use separately from on-shore use. While offshore emissions have variable effects on nonattainment area air quality, depending on meteorological conditions, it would be inappropriate to totally ignore such emissions. Thus, boat use within one mile offshore of nonattainment areas located on the ocean or the Great Lakes was used as an approximation of the offshore emission contribution. This contributed a relatively small fraction to total boat usage in most nonattainment areas.

While the number of hours of use were also reported by the survey, fuel use was chosen as a better representation of actual boat usage based upon NMMA's stated belief that the reported fuel use was likely to be more accurate than the reported hours (NMMA was concerned that the reported hours were the number of hours the boat was in the water, not the number of hours the engine was being operated).

For the eight areas surveyed by IB&A, the actual survey results for each area were used to calculate individual ratios of engines used to engines registered. For the other 16 areas, the average ratios from the eight surveyed areas were used. For all areas, separate ratios were calculated for the five different equipment types in the recreational marine category.

Because 16 of the areas were not surveyed, the average ratios determined from the eight surveyed areas exceed reasonable maximum boat use in nonattainment areas with relatively little water surface area. To account for this, a calculation of the maximum number of boats that could be operated normally on the available water surface area was made for each nonattainment area according to the following formula:

$$\text{max. boats} = \frac{\text{Water surface area in nonattainment area}}{\text{Area required/boat}}$$

The water surface area in each nonattainment area was supplied by EEA. The area required/boat was supplied by NMMA based on saturation limits determined for a joint study by EPA and marine engine manufacturers in the early 1970's (Grant No. R-801799), plus the IB&A survey results for types of boating activity.

NMMA supplied information suggesting that the available hours of prime boating use are 384 hours/year (12 weeks/year, 4 days per week, 8 hours/day). This figure was multiplied by the maximum number of boats to yield the maximum number of summer boat hours that could be supported within each nonattainment area without hindering boat activity.

This theoretical maximum number of summer boat hours inside the nonattainment area was compared to the amount of summer boat hours inside the nonattainment area calculated from the survey results and the local boat registrations. The calculation of summer boat hours from the survey and registration was made using the following formula:

$$\text{Summer hours} = \left[\sum_i (\#\ \text{n/a boats})(\text{hours})\left(\frac{\text{Fuel used in n/a area}}{\text{Fuel used by boats registered in n/a area}}\right)\right] \\ \text{x (summer usage)}$$

where:

i = each of the five equipment types in the recreational marine category
# n/a boats = # boats registered in the nonattainment area
hours = total annual hours of use per boat from the survey for boats registered in the nonattainment area (includes hours operated outside the nonattainment area)

Fuel used ... = Both terms have the same meaning as defined, above, in the formula calculating engines used in nonattainment areas.
Summer usage = reported proportion of summertime operation from the survey.

In cases where the calculated summer boat hours exceeded the theoretical maximum, the calculated number of engines used in the nonattainment area was reduced by the ratio of the theoretical maximum summer boat hours to the calculated summer boat hours. Because this correction ratio does not include offshore boat use, the average offshore use was subtracted prior to applying the correction ratio. For areas on the ocean or on a Great Lake, the average of the offshore usage proportion for the five areas with offshore use was added back after applying the correction ratio.

Annual Fuel Use Estimates -- The load factor, horsepower, and regional hours of use supplied by PSR were multiplied by the following BSFC estimates determined from test data supplied by NMMA for recreational marine engines (the BSFC calculations are discussed in Appendix I):

Diesel - 0.066 gallons/hr-hr
4-stroke gasoline - 0.1 gallons/hp-hr
2-stroke gasoline - 0.16 gallons/hp-hr

Seasonal Adjustment Factors -- Monthly usage reported by the survey respondents were used to directly establish the proportion of boat usage in the summer and the winter for six of the eight regions developed for this study. For the two regions for which no areas were surveyed, the southeast and the west coast, survey results from Houston were used.

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Appendix L. Regional and Seasonal Adjustments to Inventories

Annual hours of use data provided to EPA from the PSR data base reflect different usage patterns for different regions of the country.* In developing Inventory A, EPA made several adjustments to this data.

As ozone exceedances are typically a summertime problem and CO exceedances a wintertime problem, EPA developed seasonal adjustment factors to reflect the use of equipment depending on the season of the year.

This appendix describes the assumptions made by EPA in calculating regional hours of use and summertime and wintertime emissions.

1. Regional Adjustments

EPA has allocated the nonattainment areas studied to eight regions. Table L-01 indicates the nonattainment areas that fall into these eight regions, as well as the seasonal designations for each region.

In constructing Inventory A, EPA used annual hours of use data for each region as supplied from the PSR data base, as indicated in the EEA final report, except for the following:

- EPA created a "Mid-Atlantic Coast" region. The annual hours of use rates for equipment in this region are determined by taking the average of the data for the Northeast and Southeast regions.

- EPA created a "Rocky Mountains" region. The annual hours of use rates for equipment in this region are determined by taking the average of the data for the Great Lakes and the Northwest regions.

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*This regional annual hours of use data is documented in the Energy and Environmental Analysis final report, "Methodology to Estimate Nonroad Equipment Populations by Nonattainment Areas," available in the public docket.

Table L-01. Regional and Seasonal Designations

Region	Nonattainment Areas	Seasonal Designation
Northeast	Springfield, Hartford, Boston, New York	Cold
Southeast	Atlanta, Baton Rouge, Miami	Warm
Mid-Atlantic Coast	Baltimore, Philadelphia, Washington D.C.	Medium
Great Lakes	Chicago, Cleveland, Milwaukee, Minneapolis, St. Louis	Cold
Southwest	El Paso, Houston	Warm
Rocky Mountains	Denver, Spokane, Provo-Orem	Cold
Northwest	Seattle	Medium
West Coast	South Coast California, San Diego, San Joaquin	Warm

Regional assumptions for commercial marine vessels were not necessary as commercial marine equipment inventories were calculated directly at the regional level.

2. Seasonal Adjustment Factors

Because ozone and CO are largely summertime and wintertime problems, respectively, seasonal adjustment factors were used to determine summertime VOC and NO_X emissions and wintertime CO emissions from nonroad engines and vehicles. Yearly emissions (tons per year) were adjusted according to the following formulas:

$$tpsd = tpy \times SAF_{summer} \qquad tpwd = tpy \times SAF_{winter}$$

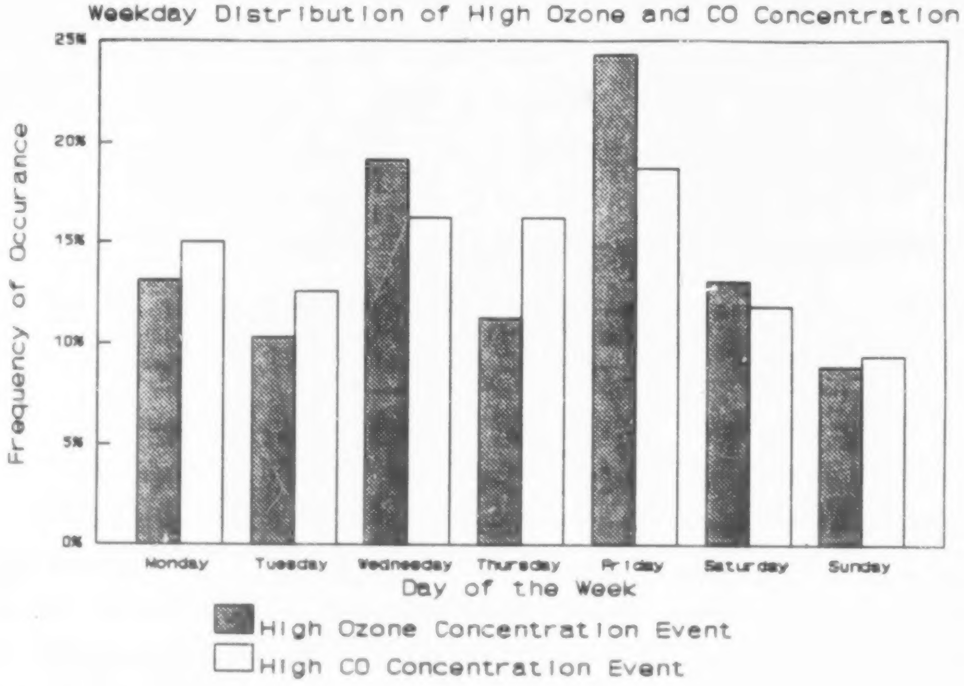
where tpsd and tpwd refer to average daily emissions during the summer and winter and the seasonal adjustment factors (SAFs) are defined as follows:

$$SAF_{summer} = 4 \times \frac{\%\ activity\ during\ summer}{365\ days}$$

$$SAF_{winter} = 4 \times \frac{\%\ activity\ during\ winter}{365\ days}$$

This study did not consider day-to-day (e.g., weekend versus weekday) or hour-to-hour activity level fluctuations. For most of the nonroad engines and vehicles studied, insufficient survey data was available to estimate activity level variations at that level of temporal resolution. Furthermore, ozone and CO exceedances occur with reasonably similar frequency on every day of the week, thus rendering suspect the value of emission inventories that make such distinctions.

The following chart shows the day-to-day distribution of ozone and CO nonattainment in the nonattainment areas included in this study. For both ozone[1] and CO[2] nonattainment, the ten days from 1986-1988 corresponding to the highest ambient concentrations are included.



As this chart shows, high ozone and CO concentrations are only 29% and 35%, respectively, less likely on weekends than on weekdays. It should also be noted that Friday contained the highest number of exceedances, possibly because of a combination of work and recreation activities. If Friday is excluded, high ozone and CO concentrations on the weekend are only 17% and 29%, respectively, less likely than during Monday through Thursday.

For the purposes of determining summer and winter adjustment factors, the nation was divided into three regions based on average January temperatures:

Cold: < 35° F
Medium: 35-44° F
Warm: > 45° F

The cold, medium, and warm regions roughly correspond to northern, central and southern regions as defined in a 1973 report by Hare and Springer[3]:

Northern:	43° north latitude and north
Central:	from 37° to 43°
Southern:	37° and south

EPA seasonal adjustment factors have been calculated based on data from Hare and Springer, the CARB Technical Support Document for proposed regulations applicable to lawn and garden equipment,[4] 1987 SIP emission inventories, the Motorcycle Industry Council (MIC),[5] and the NMMA,[6] as detailed below. Seasonal activity percentages were estimated for the 3-month summer and winter periods as shown in Table L-02.

Table L-02. Summer and Winter Percentages of Yearly Activity.

Equipment Category	Cold/Northern		Medium/Central		Warm/Southern	
	Summer (%)	Winter (%)	Summer (%)	Winter (%)	Summer (%)	Winter (%)
Agricultural	50	6	40	6	34	6
Construction	43	10	38	15	33	20
Industrial	30	20	25	25	25	25
Lawn and Garden (excl. chain saws)	50	6	40	6	34	6
Snowblowers/Snowmobiles	0	100	0	100	0	100
Commercial Marine	25	25	25	25	25	25
Airport Service	25	25	25	25	25	25
Logging (including chain saws)	25	25	25	25	25	25
Light Commercial	25	25	25	25	25	25

Hare and Springer reported construction seasons of 7, 8, and 9 months for the north, central, and southern regions, respectively. This corresponds to summer activity percentages of 43%, 38%, and 33% in the same regions. The 1987 SIP emission inventories for Denver and Atlanta reported wintertime activity percentages of 10% and 20%, respectively. These figures were applied to areas in the northern and southern regions. In this study, it was estimated that the wintertime activity percentage in the central region was 15%.

Hare and Springer also reported agricultural seasons of 180, 225, and 270 days for the northern, central, and southern regions, respectively. This corresponds to summer activity percentages of 50%, 40%, and 34% in the same regions. The 1987 SIP emission inventories for both Boston and Atlanta reported that 90% of agricultural equipment activity occurs between April and October, yielding a wintertime activity percentage of 6% in both areas. This figure was herein applied to all nonattainment areas to estimate wintertime agricultural equipment activity.

Because of similarities in the growing seasons, summertime activity percentages for lawn and garden equipment (excluding chain saws and snowblowers) were estimated to be the same as those for agricultural equipment. CARB estimated in the Technical Support Document for its proposed regulations applicable to lawn and garden equipment that wintertime activity accounted for about 6% of yearly activity. This figure was applied to the southern region, and the wintertime activity percentages in the central and northern regions were estimated to be 3% and 0%. However, it was assumed that all snowblower activity occurs during the winter.

The industrial equipment seasonal activity percentages listed above are based on seasonal adjustments used in several 1987 SIP emission inventories. Of those considered in this studied, only that for Chicago reported any nonuniformity of industrial equipment activity - the summer portion of yearly activity was reported to be 30%. This figure was applied to the northern region, and the wintertime activity percentage was consequently estimated to be 20%. Activity in the central and southern regions was estimated to be uniformly distributed across the year.

Due to the year-round nature of equipment use, no seasonal adjustments were made to activity for commercial marine vessels, airport service vehicles, logging equipment (including all chain saws), or light commercial equipment. The survey conducted by NMMA of recreation boat owners included information on seasonal boat usage. These results were used to establish seasonal adjustments for each of the eight regions used for regional hours of use adjustment as shown in Table L-03.

For recreational land-based equipment (e.g., off-highway motorcycles, ATVs, minibikes) other than snowmobiles, survey data submitted to EPA by the Motorcycle Industry

Council (MIC) was used. This survey divided the nation into 12 regions as shown in Table L-04.

Table L-03. Summer and Winter Percentages of Yearly Activity for Recreational Marine Equipment

Region	% During Summer	% During Winter
Northeast	68	1
Southeast	48	7
Mid-Atlantic Coast	57	2
Great Lakes	70	0
Southwest	48	7
Rocky Mountains	69	0
Northwest	57	5
West Coast	48	7

Table L-04. Summer and Winter Percentages of Yearly Activity for Recreational Equipment.[†]

Region	% During Summer	% During Winter
East	42	12
Midwest	46	8
South	36	15
West	44	11
New England	44	14
Mid-Atlantic Coast	41	12
East Central	48	9
West Central	44	8
Southeast	35	17
Southwest	37	12
Rocky Mountains	44	8
Pacific	43	13
National Average	42	12

The following tables show the seasonal adjustment factors used for each equipment type in each nonattainment area studied by EPA. To ease interpretation, they are expressed as SAF^{-1}. Using this notation, the following percentages of annual use occurring during a three month season would translate into the following factors:

[†] Excluding snowmobiles.

Table L-05. Examples of Seasonal Activity Percentages and Corresponding Values for SAF and SAF^{1}

Percent During Season	SAF	SAF^{-1}
10	0.00110	909
25	0.00274	365
35	0.00384	260
50	0.00548	183

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	Seasonal Adjustment Factors	0		1		2		3		4		5		6		7		8	
		Baltimore CMSA		Chicago CMSA		Denver CMSA		Houston CMSA		Milwaukee CMSA		Boston NECMA		Hartford NECMA		New York CMSA		Philadel. CMSA	
Class	Equipment Types	tpy/tpsd	tpy/tpwd	tpy/tpsd	tpy/tpwd	tpy/tpsd	tpy/tpwd	tpy/tpsd	tpy/tpwd	tpy/tpsd	tpy/tpwd	tpy/tpsd	tpy/tpwd	tpy/tpsd	tpy/tpwd	tpy/tpsd	tpy/tpwd	tpy/tpsd	tpy/tpwd
1	Trimmers/Edgers/Brush Cutters	228	3041	182	1.00E+09	182	1.00E+09	288	1520	182	1.00E+09	182	1.00E+09	182	1.00E+09	182	1.00E+09	228	3041
1	Lawn Mowers	228	3041	182	1.00E+09	182	1.00E+09	288	1520	182	1.00E+09	182	1.00E+09	182	1.00E+09	182	1.00E+09	228	3041
1	Leaf Blowers/Vacuums	228	3041	182	1.00E+09	182	1.00E+09	288	1520	182	1.00E+09	182	1.00E+09	182	1.00E+09	182	1.00E+09	228	3041
1	Rear Engine Riding Mowers	228	3041	182	1.00E+09	182	1.00E+09	288	1520	182	1.00E+09	182	1.00E+09	182	1.00E+09	182	1.00E+09	228	3041
1	Front Mowers	228	3041	182	1.00E+09	182	1.00E+09	288	1520	182	1.00E+09	182	1.00E+09	182	1.00E+09	182	1.00E+09	228	3041
1	Chainsaws <4 HP	365	365	182	1.00E+09	182	1.00E+09	365	365	182	1.00E+09	182	1.00E+09	182	1.00E+09	182	1.00E+09	365	365
1	Shredders <5 HP	228	3041	182	1.00E+09	182	1.00E+09	288	1520	182	1.00E+09	182	1.00E+09	182	1.00E+09	182	1.00E+09	228	3041
1	Tillers <5 HP	228	3041	182	1.00E+09	182	1.00E+09	288	1520	182	1.00E+09	182	1.00E+09	182	1.00E+09	182	1.00E+09	228	3041
1	Lawn & Garden Tractors	228	3041	182	1.00E+09	182	1.00E+09	288	1520	182	1.00E+09	182	1.00E+09	182	1.00E+09	182	1.00E+09	228	3041
1	Wood Splitters	228	3041	182	1.00E+09	182	1.00E+09	288	1520	182	1.00E+09	182	1.00E+09	182	1.00E+09	182	1.00E+09	228	3041
1	Snowblowers	1.00E+09	91	1.00E+09	91	1.00E+09	91	1.00E+09	91	1.00E+09	91	1.00E+09	91	1.00E+09	91	1.00E+09	91	1.00E+09	91
1	Chippers/Stump Grinders	228	3041	182	1.00E+09	182	1.00E+09	288	1520	182	1.00E+09	182	1.00E+09	182	1.00E+09	182	1.00E+09	228	3041
1	Commercial Turf Equipment	228	3041	182	1.00E+09	182	1.00E+09	288	1520	182	1.00E+09	182	1.00E+09	182	1.00E+09	182	1.00E+09	228	3041
1	Other Lawn & Garden Equipment	228	3041	182	1.00E+09	182	1.00E+09	288	1520	182	1.00E+09	182	1.00E+09	182	1.00E+09	182	1.00E+09	228	3041
3	All Terrain Vehicles (ATVs)	222	780	190	1014	207	1140	246	780	207	1140	207	652	207	652	223	780	222	780
3	Minibikes	222	780	190	1014	207	1140	246	780	207	1140	207	652	207	652	223	780	222	780
3	Off-Road Motorcycles	222	780	190	1014	207	1140	246	780	207	1140	207	652	207	652	223	780	222	780
3	Golf Carts	222	780	190	1014	207	1140	246	780	207	1140	207	652	207	652	223	780	222	780
3	Snowmobiles	1.00E+09	91	1.00E+09	91	1.00E+09	91	1.00E+09	91	1.00E+09	91	1.00E+09	91	1.00E+09	91	1.00E+09	91	1.00E+09	91
3	Specialty Vehicles Carts	222	780	190	1014	207	1140	246	780	207	1140	207	652	207	652	223	780	222	780
5	Generator Sets <50 HP	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365
5	Pumps <50 HP	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365
5	Air Compressors <50 HP	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365
5	Gas Compressors <50 HP	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365
5	Welders <50 HP	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365
5	Pressure Washers <50 HP	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365
6	Aerial Lifts	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365
6	Forklifts	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365
6	Sweepers/Scrubbers	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365
6	Other General Industrial Equipment	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365
6	Other Material Handling Equipment	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365
7	Asphalt Pavers	240	608	212	912	212	912	278	486	212	912	212	912	212	912	212	912	240	608
7	Tampers/Rammers	240	608	212	912	212	912	278	486	212	912	212	912	212	912	212	912	240	608
7	Plate Compactors	240	608	212	912	212	912	278	486	212	912	212	912	212	912	212	912	240	608
7	Concrete Pavers	240	608	212	912	212	912	278	486	212	912	212	912	212	912	212	912	240	608
7	Rollers	240	608	212	912	212	912	278	486	212	912	212	912	212	912	212	912	240	608
7	Scrapers	240	608	212	912	212	912	278	486	212	912	212	912	212	912	212	912	240	608
7	Paving Equipment	240	608	212	912	212	912	278	486	212	912	212	912	212	912	212	912	240	608
7	Surfacing Equipment	240	608	212	912	212	912	278	486	212	912	212	912	212	912	212	912	240	608
7	Signal Boards	240	608	212	912	212	912	278	486	212	912	212	912	212	912	212	912	240	608
7	Trenchers	240	608	212	912	212	912	278	486	212	912	212	912	212	912	212	912	240	608
7	Bore/Drill Rigs	240	608	212	912	212	912	278	486	212	912	212	912	212	912	212	912	240	608
7	Excavators	240	608	212	912	212	912	278	486	212	912	212	912	212	912	212	912	240	608
7	Concrete/Industrial Saws	240	608	212	912	212	912	278	486	212	912	212	912	212	912	212	912	240	608
7	Cement and Mortar Mixers	240	608	212	912	212	912	278	486	212	912	212	912	212	912	212	912	240	608
7	Cranes	240	608	212	912	212	912	278	486	212	912	212	912	212	912	212	912	240	608
7	Graders	240	608	212	912	212	912	278	486	212	912	212	912	212	912	212	912	240	608
7	Off-Highway Trucks	240	608	212	912	212	912	278	486	212	912	212	912	212	912	212	912	240	608
7	Crushing/Proc. Equipment	240	608	212	912	212	912	278	486	212	912	212	912	212	912	212	912	240	608
7	Rough Terrain Forklifts	240	608	212	912	212	912	278	486	212	912	212	912	212	912	212	912	240	608
7	Rubber Tired Loaders	240	608	212	912	212	912	278	486	212	912	212	912	212	912	212	912	240	608
7	Rubber Tired Dozers	240	608	212	912	212	912	278	486	212	912	212	912	212	912	212	912	240	608
7	Tractors/Loaders/Backhoes	240	608	212	912	212	912	278	486	212	912	212	912	212	912	212	912	240	608
7	Crawler Tractors	240	608	212	912	212	912	278	486	212	912	212	912	212	912	212	912	240	608
7	Skid Steer Loaders	240	608	212	912	212	912	278	486	212	912	212	912	212	912	212	912	240	608
7	Off-Highway Tractors	240	608	212	912	212	912	278	486	212	912	212	912	212	912	212	912	240	608
7	Dumpers/Tenders	240	608	212	912	212	912	278	486	212	912	212	912	212	912	212	912	240	608
7	Other Construction Equipment	240	608	212	912	212	912	278	486	212	912	212	912	212	912	212	912	240	608
8	2-Wheel Tractors	228	1520	182	1520	182	1520	288	1520	182	1520	182	1520	182	1520	182	1520	228	1520
8	Agricultural Tractors	228	1520	182	1520	182	1520	288	1520	182	1520	182	1520	182	1520	182	1520	228	1520
8	Agricultural Mowers	228	1520	182	1520	182	1520	288	1520	182	1520	182	1520	182	1520	182	1520	228	1520
8	Combines	228	1520	182	1520	182	1520	288	1520	182	1520	182	1520	182	1520	182	1520	228	1520
8	Sprayers	228	1520	182	1520	182	1520	288	1520	182	1520	182	1520	182	1520	182	1520	228	1520
8	Balers	228	1520	182	1520	182	1520	288	1520	182	1520	182	1520	182	1520	182	1520	228	1520
8	Tillers >5 HP	228	1520	182	1520	182	1520	288	1520	182	1520	182	1520	182	1520	182	1520	228	1520
8	Swathers	228	1520	182	1520	182	1520	288	1520	182	1520	182	1520	182	1520	182	1520	228	1520
8	Hydro Power Units	228	1520	182	1520	182	1520	288	1520	182	1520	182	1520	182	1520	182	1520	228	1520
8	Other Agricultural Equipment	228	1520	182	1520	182	1520	288	1520	182	1520	182	1520	182	1520	182	1520	228	1520
9	Chainsaws >4 HP	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365
9	Shredders >5 HP	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365
9	Skidders	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365
9	Fellers/Bunchers	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365
2	Aircraft Support Equipment	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365
2	Terminal Tractors	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365
4	Vessels w/Inboard Engines	180	4563	130	1.00E+09	132	1.00E+09	190	1304	130	1.00E+09	134	9125	134	9125	134	9125	180	4563
4	Vessels w/Outboard Engines	180	4563	130	1.00E+09	132	1.00E+09	190	1304	130	1.00E+09	134	9125	134	9125	134	9125	180	4563
4	Vessels w/Sterndrive Engines	180	4563	130	1.00E+09	132	1.00E+09	190	1304	130	1.00E+09	134	9125	134	9125	134	9125	180	4563
4	Sailboat Auxiliary Inboard Engines	180	4563	130	1.00E+09	132	1.00E+09	190	1304	130	1.00E+09	134	9125	134	9125	134	9125	180	4563
4	Sailboat Auxiliary Outboard Engines	180	4563	130	1.00E+09	132	1.00E+09	190	1304	130	1.00E+09	134	9125	134	9125	134	9125	180	4563

Seasonal Adjustment Factors

Class	Equipment Types	9 Seat.-Tac CMSA		10 Atlanta CMSA		11 Baton Rouge CMSA		12 Cleveland CMSA		13 El Paso CMSA		14 San Jq. Val. AB		15 South Coast AB		16 Miami CMSA		17 Min.-St.Paul CMSA	
		tpy/tpsd	tpy/twpd	tpy/tpsd	tpy/twpd	tpy/tpsd	tpy/twpd	tpy/tpsd	tpy/twpd	tpy/tpsd	tpy/twpd	tpy/tpsd	tpy/twpd	tpy/tpsd	tpy/twpd	tpy/tpsd	tpy/twpd	tpy/tpsd	tpy/twpd
1	Trimmers/Edgers/Brush Cutters	228	3041	288	1520	288	1520	182	1.00E+00	288	1520	288	1520	288	1520	288	1520	182	1.00E+00
1	Lawn Mowers	228	3041	288	1520	288	1520	182	1.00E+00	288	1520	288	1520	288	1520	288	1520	182	1.00E+00
1	Leaf Blowers/Vacuums	228	3041	288	1520	288	1520	182	1.00E+00	288	1520	288	1520	288	1520	288	1520	182	1.00E+00
1	Rear Engine Riding Mowers	228	3041	288	1520	288	1520	182	1.00E+00	288	1520	288	1520	288	1520	288	1520	182	1.00E+00
1	Front Mowers	228	3041	288	1520	288	1520	182	1.00E+00	288	1520	288	1520	288	1520	288	1520	182	1.00E+00
1	Chainsaws <4 HP	365	365	365	365	365	365	182	1.00E+00	365	365	365	365	365	365	365	365	182	1.00E+00
1	Shredders <5 HP	228	3041	288	1520	288	1520	182	1.00E+00	288	1520	288	1520	288	1520	288	1520	182	1.00E+00
1	Tillers <5 HP	228	3041	288	1520	288	1520	182	1.00E+00	288	1520	288	1520	288	1520	288	1520	182	1.00E+00
1	Lawn & Garden Tractors	228	3041	288	1520	288	1520	182	1.00E+00	288	1520	288	1520	288	1520	288	1520	182	1.00E+00
1	Wood Splitters	228	3041	288	1520	288	1520	182	1.00E+00	288	1520	288	1520	288	1520	288	1520	182	1.00E+00
1	Snowblowers	1.00E+00	91	1.00E+00	91	1.00E+00	91	1.00E+00	91	1.00E+00	91	1.00E+00	91	1.00E+00	91	1.00E+00	91	1.00E+00	91
1	Chippers/Stump Grinders	228	3041	288	1520	288	1520	182	1.00E+00	288	1520	288	1520	288	1520	288	1520	182	1.00E+00
1	Commercial Turf Equipment	228	3041	288	1520	288	1520	182	1.00E+00	288	1520	288	1520	288	1520	288	1520	182	1.00E+00
1	Other Lawn & Garden Equipment	228	3041	288	1520	288	1520	182	1.00E+00	288	1520	288	1520	288	1520	288	1520	182	1.00E+00
3	All Terrain Vehicles (ATVs)	212	702	280	838	248	760	190	1014	248	760	212	701	248	701	280	838	207	1140
3	Minibikes	212	702	280	838	248	760	190	1014	248	760	212	701	248	701	280	838	207	1140
3	Off-Road Motorcycles	212	702	280	838	248	760	190	1014	248	760	212	701	248	701	280	838	207	1140
3	Golf Carts	212	702	280	838	248	760	190	1014	248	760	212	701	248	701	280	838	207	1140
3	Snowmobiles	1.00E+00	91	1.00E+00	91	1.00E+00	91	1.00E+00	91	1.00E+00	91	1.00E+00	91	1.00E+00	91	1.00E+00	91	1.00E+00	91
3	Specialty Vehicles Carts	212	702	280	838	248	760	190	1014	248	760	212	701	248	701	280	838	207	1140
5	Generator Sets <50 HP	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365
5	Pumps <50 HP	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365
5	Air Compressors <50 HP	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365
5	Gas Compressors <50 HP	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365
5	Welders <50 HP	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365
5	Pressure Washers <50 HP	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365
6	Aerial Lifts	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365
6	Forklifts	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365
6	Sweepers/Scrubbers	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365
6	Other General Industrial Equipment	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365
6	Other Material Handling Equipment	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365
7	Asphalt Pavers	240	608	278	486	278	486	212	912	278	486	278	486	278	486	278	486	212	912
7	Tampers/Rammers	240	608	278	486	278	486	212	912	278	486	278	486	278	486	278	486	212	912
7	Plate Compactors	240	608	278	486	278	486	212	912	278	486	278	486	278	486	278	486	212	912
7	Concrete Pavers	240	608	278	486	278	486	212	912	278	486	278	486	278	486	278	486	212	912
7	Rollers	240	608	278	486	278	486	212	912	278	486	278	486	278	486	278	486	212	912
7	Scrapers	240	608	278	486	278	486	212	912	278	486	278	486	278	486	278	486	212	912
7	Paving Equipment	240	608	278	486	278	486	212	912	278	486	278	486	278	486	278	486	212	912
7	Surfacing Equipment	240	608	278	486	278	486	212	912	278	486	278	486	278	486	278	486	212	912
7	Signal Boards	240	608	278	486	278	486	212	912	278	486	278	486	278	486	278	486	212	912
7	Trenchers	240	608	278	486	278	486	212	912	278	486	278	486	278	486	278	486	212	912
7	Bore/Drill Rigs	240	608	278	486	278	486	212	912	278	486	278	486	278	486	278	486	212	912
7	Excavators	240	608	278	486	278	486	212	912	278	486	278	486	278	486	278	486	212	912
7	Concrete/Industrial Saws	240	608	278	486	278	486	212	912	278	486	278	486	278	486	278	486	212	912
7	Cement and Mortar Mixers	240	608	278	486	278	486	212	912	278	486	278	486	278	486	278	486	212	912
7	Cranes	240	608	278	486	278	486	212	912	278	486	278	486	278	486	278	486	212	912
7	Graders	240	608	278	486	278	486	212	912	278	486	278	486	278	486	278	486	212	912
7	Off-Highway Trucks	240	608	278	486	278	486	212	912	278	486	278	486	278	486	278	486	212	912
7	Crushing/Proc. Equipment	240	608	278	486	278	486	212	912	278	486	278	486	278	486	278	486	212	912
7	Rough Terrain Forklifts	240	608	278	486	278	486	212	912	278	486	278	486	278	486	278	486	212	912
7	Rubber Tired Loaders	240	608	278	486	278	486	212	912	278	486	278	486	278	486	278	486	212	912
7	Rubber Tired Dozers	240	608	278	486	278	486	212	912	278	486	278	486	278	486	278	486	212	912
7	Tractors/Loaders/Backhoes	240	608	278	486	278	486	212	912	278	486	278	486	278	486	278	486	212	912
7	Crawler Tractors	240	608	278	486	278	486	212	912	278	486	278	486	278	486	278	486	212	912
7	Skid Steer Loaders	240	608	278	486	278	486	212	912	278	486	278	486	278	486	278	486	212	912
7	Off-Highway Tractors	240	608	278	486	278	486	212	912	278	486	278	486	278	486	278	486	212	912
7	Dumpers/Tenders	240	608	278	486	278	486	212	912	278	486	278	486	278	486	278	486	212	912
7	Other Construction Equipment	240	608	278	486	278	486	212	912	278	486	278	486	278	486	278	486	212	912
8	2-Wheel Tractors	228	1520	288	1520	288	1520	182	1520	288	1520	288	1520	288	1520	288	1520	182	1520
8	Agricultural Tractors	228	1520	288	1520	288	1520	182	1520	288	1520	288	1520	288	1520	288	1520	182	1520
8	Agricultural Mowers	228	1520	288	1520	288	1520	182	1520	288	1520	288	1520	288	1520	288	1520	182	1520
8	Combines	228	1520	288	1520	288	1520	182	1520	288	1520	288	1520	288	1520	288	1520	182	1520
8	Sprayers	228	1520	288	1520	288	1520	182	1520	288	1520	288	1520	288	1520	288	1520	182	1520
8	Balers	228	1520	288	1520	288	1520	182	1520	288	1520	288	1520	288	1520	288	1520	182	1520
8	Tillers >5 HP	228	1520	288	1520	288	1520	182	1520	288	1520	288	1520	288	1520	288	1520	182	1520
8	Swathers	228	1520	288	1520	288	1520	182	1520	288	1520	288	1520	288	1520	288	1520	182	1520
8	Hydro Power Units	228	1520	288	1520	288	1520	182	1520	288	1520	288	1520	288	1520	288	1520	182	1520
8	Other Agricultural Equipment	228	1520	288	1520	288	1520	182	1520	288	1520	288	1520	288	1520	288	1520	182	1520
9	Chainsaws >4 HP	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365
9	Shredders >5 HP	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365
9	Skidders	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365
9	Fellers/Bunchers	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365
2	Aircraft Support Equipment	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365
2	Terminal Tractors	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365	365
4	Vessels w/Inboard Engines	180	1825	190	1304	190	1304	130	1.00E+00	190	1304	190	1304	190	1304	190	1304	130	1.00E+00
4	Vessels w/Outboard Engines	180	1825	190	1304	190	1304	130	1.00E+00	190	1304	190	1304	190	1304	190	1304	130	1.00E+00
4	Vessels w/Sterndrive Engines	180	1825	190	1304	190	1304	130	1.00E+00	190	1304	190	1304	190	1304	190	1304	130	1.00E+00
4	Sailboat Auxiliary Inboard Engines	180	1825	190	1304	190	1304	130	1.00E+00	190	1304	190	1304	190	1304	190	1304	130	1.00E+00
4	Sailboat Auxiliary Outboard Engines	180	1825	190	1304	190	1304	130	1.00E+00	190	1304	190	1304	190	1304	190	1304	130	1.00E+00

Reproduced from
best available copy.

	Seasonal Adjustment Factors	18		19		20		21		22		23		24	
		Provo-Orem CMSA		San Diego AB		Spokane CMSA		St. Louis CMSA		Washington DC CMSA		Springfield NECMA		Nation - St. D.C. values	
Class	Equipment Types	tpy/tpsd	tpy/tpwd	tpy/tpsd	tpy/tpwd	tpy/tpsd	tpy/tpwd	tpy/tpsd	tpy/tpwd	tpy/tpsd	tpy/tpwd	tpy/tpsd	tpy/tpwd	tpy/tpsd	tpy/tpwd
1	Trimmers/Edgers/Brush Cutters	182	1.00E+09	288	1520	182	1.00E+09	182	1.00E+09	228	3041	182	1.00E+09	228	3041
1	Lawn Mowers	182	1.00E+09	288	1520	182	1.00E+09	182	1.00E+09	228	3041	182	1.00E+09	228	3041
1	Leaf Blowers/Vacuums	182	1.00E+09	288	1520	182	1.00E+09	182	1.00E+09	228	3041	182	1.00E+09	228	3041
1	Rear Engine Riding Mowers	182	1.00E+09	288	1520	182	1.00E+09	182	1.00E+09	228	3041	182	1.00E+09	228	3041
1	Front Mowers	182	1.00E+09	288	1520	182	1.00E+09	182	1.00E+09	228	3041	182	1.00E+09	228	3041
1	Chainsaws <4 HP	182	1.00E+09	365	365	182	1.00E+09	182	1.00E+09	365	365	182	1.00E+09	365	365
1	Shredders <5 HP	182	1.00E+09	288	1520	182	1.00E+09	182	1.00E+09	228	3041	182	1.00E+09	228	3041
1	Tillers <5 HP	182	1.00E+09	288	1520	182	1.00E+09	182	1.00E+09	228	3041	182	1.00E+09	228	3041
1	Lawn & Garden Tractors	182	1.00E+09	288	1520	182	1.00E+09	182	1.00E+09	228	3041	182	1.00E+09	228	3041
1	Wood Splitters	182	1.00E+09	288	1520	182	1.00E+09	182	1.00E+09	228	3041	182	1.00E+09	228	3041
1	Snowblowers	1.00E+09	91	1.00E+09	91	1.00E+09	91	1.00E+09	91	1.00E+09	91	1.00E+09	91	1.0E+09	91
1	Chippers/Stump Grinders	182	1.00E+09	288	1520	182	1.00E+09	182	1.00E+09	228	3041	182	1.00E+09	228	3041
1	Commercial Turf Equipment	182	1.00E+09	288	1520	182	1.00E+09	182	1.00E+09	228	3041	182	1.00E+09	228	3041
1	Other Lawn & Garden Equipment	182	1.00E+09	288	1520	182	1.00E+09	182	1.00E+09	228	3041	182	1.00E+09	228	3041
3	All Terrain Vehicles (ATVs)	207	1140	348	701	212	1140	207	1140	232	780	207	682	222	780
3	Minibikes	207	1140	348	701	212	1140	207	1140	232	780	207	682	222	780
3	Off-Road Motorcycles	207	1140	348	701	212	1140	207	1140	232	780	207	682	222	780
3	Golf Carts	207	1140	348	701	212	1140	207	1140	232	780	207	682	222	780
3	Snowmobiles	1.00E+09	91	1.00E+09	91	1.00E+09	91	1.00E+09	91	1.00E+09	91	1.00E+09	91	1.0E+09	91
3	Specialty Vehicles Carts	207	1140	348	701	212	1140	207	1140	232	780	207	682	222	780
5	Generator Sets <50 HP	365	365	365	365	365	365	365	365	365	365	365	365	365	365
5	Pumps <50 HP	365	365	365	365	365	365	365	365	365	365	365	365	365	365
5	Air Compressors <50 HP	365	365	365	365	365	365	365	365	365	365	365	365	365	365
5	Gas Compressors <50 HP	365	365	365	365	365	365	365	365	365	365	365	365	365	365
5	Welders <50 HP	365	365	365	365	365	365	365	365	365	365	365	365	365	365
5	Pressure Washers <50 HP	365	365	365	365	365	365	365	365	365	365	365	365	365	365
6	Aerial Lifts	365	365	365	365	365	365	365	365	365	365	365	365	365	365
6	Forklifts	365	365	365	365	365	365	365	365	365	365	365	365	365	365
6	Sweepers/Scrubbers	365	365	365	365	365	365	365	365	365	365	365	365	365	365
6	Other General Industrial Equipment	365	365	365	365	365	365	365	365	365	365	365	365	365	365
6	Other Material Handling Equipment	365	365	365	365	365	365	365	365	365	365	365	365	365	365
7	Asphalt Pavers	212	912	278	466	212	912	212	912	240	608	212	912	240	608
7	Tampers/Rammers	212	912	278	466	212	912	212	912	240	608	212	912	240	608
7	Plate Compactors	212	912	278	466	212	912	212	912	240	608	212	912	240	608
7	Concrete Pavers	212	912	278	466	212	912	212	912	240	608	212	912	240	608
7	Rollers	212	912	278	466	212	912	212	912	240	608	212	912	240	608
7	Scrapers	212	912	278	466	212	912	212	912	240	608	212	912	240	608
7	Paving Equipment	212	912	278	466	212	912	212	912	240	608	212	912	240	608
7	Surfacing Equipment	212	912	278	466	212	912	212	912	240	608	212	912	240	608
7	Signal Boards	212	912	278	466	212	912	212	912	240	608	212	912	240	608
7	Trenchers	212	912	278	466	212	912	212	912	240	608	212	912	240	608
7	Bore/Drill Rigs	212	912	278	466	212	912	212	912	240	608	212	912	240	608
7	Excavators	212	912	278	466	212	912	212	912	240	608	212	912	240	608
7	Concrete/Industrial Saws	212	912	278	466	212	912	212	912	240	608	212	912	240	608
7	Cement and Mortar Mixers	212	912	278	466	212	912	212	912	240	608	212	912	240	608
7	Cranes	212	912	278	466	212	912	212	912	240	608	212	912	240	608
7	Graders	212	912	278	466	212	912	212	912	240	608	212	912	240	608
7	Off-Highway Trucks	212	912	278	466	212	912	212	912	240	608	212	912	240	608
7	Crushing/Proc. Equipment	212	912	278	466	212	912	212	912	240	608	212	912	240	608
7	Rough Terrain Forklifts	212	912	278	466	212	912	212	912	240	608	212	912	240	608
7	Rubber Tired Loaders	212	912	278	466	212	912	212	912	240	608	212	912	240	608
7	Rubber Tired Dozers	212	912	278	466	212	912	212	912	240	608	212	912	240	608
7	Tractors/Loaders/Backhoes	212	912	278	466	212	912	212	912	240	608	212	912	240	608
7	Crawler Tractors	212	912	278	466	212	912	212	912	240	608	212	912	240	608
7	Skid Steer Loaders	212	912	278	466	212	912	212	912	240	608	212	912	240	608
7	Off-Highway Tractors	212	912	278	466	212	912	212	912	240	608	212	912	240	608
7	Dumpers/Tenders	212	912	278	466	212	912	212	912	240	608	212	912	240	608
7	Other Construction Equipment	212	912	278	466	212	912	212	912	240	608	212	912	240	608
8	2-Wheel Tractors	182	1520	288	1520	182	1520	182	1520	228	1520	182	1520	228	1520
8	Agricultural Tractors	182	1520	288	1520	182	1520	182	1520	228	1520	182	1520	228	1520
8	Agricultural Mowers	182	1520	288	1520	182	1520	182	1520	228	1520	182	1520	228	1520
8	Combines	182	1520	288	1520	182	1520	182	1520	228	1520	182	1520	228	1520
8	Sprayers	182	1520	288	1520	182	1520	182	1520	228	1520	182	1520	228	1520
8	Balers	182	1520	288	1520	182	1520	182	1520	228	1520	182	1520	228	1520
8	Tillers >5 HP	182	1520	288	1520	182	1520	182	1520	228	1520	182	1520	228	1520
8	Swathers	182	1520	288	1520	182	1520	182	1520	228	1520	182	1520	228	1520
8	Hydro Power Units	182	1520	288	1520	182	1520	182	1520	228	1520	182	1520	228	1520
8	Other Agricultural Equipment	182	1520	288	1520	182	1520	182	1520	228	1520	182	1520	228	1520
9	Chainsaws >4 HP	365	365	365	365	365	365	365	365	365	365	365	365	365	365
9	Shredders >5 HP	365	365	365	365	365	365	365	365	365	365	365	365	365	365
9	Skidders	365	365	365	365	365	365	365	365	365	365	365	365	365	365
9	Fellers/Bunchers	365	365	365	365	365	365	365	365	365	365	365	365	365	365
2	Aircraft Support Equipment	365	365	365	365	365	365	365	365	365	365	365	365	365	365
2	Terminal Tractors	365	365	365	365	365	365	365	365	365	365	365	365	365	365
4	Vessels w/Inboard Engines	132	1.00E+09	190	1304	132	1.00E+09	130	1.00E+09	160	4563	134	9125	160	4563
4	Vessels w/Outboard Engines	132	1.00E+09	190	1304	132	1.00E+09	130	1.00E+09	160	4563	134	9125	160	4563
4	Vessels w/Sterndrive Engines	132	1.00E+09	190	1304	132	1.00E+09	130	1.00E+09	160	4563	134	9125	160	4563
4	Sailboat Auxiliary Inboard Engines	132	1.00E+09	190	1304	132	1.00E+09	130	1.00E+09	160	4563	134	9125	160	4563
4	Sailboat Auxiliary Outboard Engines	132	1.00E+09	190	1304	132	1.00E+09	130	1.00E+09	160	4563	134	9125	160	4563

References

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4. California Air Resources Board. *Technical Support Documents for California Exhaust Emission Standards and Test Procedures for 1994 and Subsequent Model Year Utility and Lawn and Garden Equipment Engines.* Attachment C to CARB Mailout #90-64. El Monte, CA:State of California, December 1991.

5. Burke Marketing Research. *1990 Survey of Motorcycle Ownership and Usage: Final Results Waves 1-12, Volume II.* Conducted for the Motorcycle Industry Council, Inc. May 1991.

6. Irwin Broh & Associates, Inc. *NMMA Boat Usage Survey.* Prepared for the National Marine Manufacturers Association, Des Plaines, IL, August 1991.

Appendix M. Emission Inventory A

Inventory A is presented in two sets of tables which summarize emissions from nonroad engines and vehicles, highway vehicles, and other area and point sources of emissions. Each set of tables summarizes emissions in each of the 24 nonattainment areas included in this study, as well as national emissions.

In the first set of summary tables, nonroad emissions are calculated using new engine emission factors. In the second set of summary tables, nonroad emissions are calculated using in-use emission factors.

USA Inventory A
Emission Inventory Summary - VOC, NOx, CO

	tpy			tpsd		tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	466,183	23,473	3,588,410	1,827	101	2,339
Airport Service	15,657	104,233	126,673	43	286	347
Recreational	359,679	6,605	725,401	430	11	4,874
Recreational Marine	1,283,933	87,573	3,691,227	7,888	547	809
Light Commercial	102,917	37,255	1,954,589	288	102	5,355
Industrial	77,310	237,897	1,088,487	217	652	2,982
Construction	146,978	1,026,774	830,745	612	4,276	1,366
Agricultural	206,249	936,052	931,951	904	4,103	613
Logging	18,334	78,008	117,187	50	214	321
Marine Vessels	543,464	218,799	1,822,527	1,489	599	4,993
Nonroad Engines and Vehicles	3,220,704	2,756,669	14,877,197	13,749	10,892	23,999
Highway Vehicles	5,639,454	6,547,763	36,034,743	16,996	19,733	84,904
Other Area and Point Sources	13,684,163	13,955,333	24,460,414	37,491	38,234	87,207
All Sources	22,544,321	23,259,765	75,372,354	68,236	68,859	196,109

USA Inventory A
Emission Inventory Summary - VOC, NOx, CO
Percent of Total Inventory

	% total tpy			% total tpsd		% total tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	2.07%	0.10%	4.76%	2.68%	0.15%	1.19%
Airport Service	0.07%	0.45%	0.17%	0.06%	0.41%	0.18%
Recreational	1.60%	0.03%	0.96%	0.63%	0.02%	2.49%
Recreational Marine	5.70%	0.38%	4.90%	11.56%	0.79%	0.41%
Light Commercial	0.46%	0.16%	2.59%	0.42%	0.15%	2.73%
Industrial	0.34%	1.02%	1.44%	0.32%	0.95%	1.52%
Construction	0.65%	4.41%	1.10%	0.90%	6.21%	0.70%
Agricultural	0.91%	4.02%	1.24%	1.32%	5.96%	0.31%
Logging	0.08%	0.34%	0.16%	0.07%	0.31%	0.16%
Marine Vessels	2.41%	0.94%	2.42%	2.18%	0.87%	2.55%
Nonroad Engines and Vehicles	14.29%	11.85%	19.74%	20.15%	15.82%	12.24%
Highway Vehicles	25.01%	28.15%	47.81%	24.91%	28.66%	43.29%
Other Area and Point Sources	60.70%	60.00%	32.45%	54.94%	55.53%	44.47%
All Sources	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

USA Inventory A
Emission Inventory Summary - Air Toxics and SOx

	tpy					
Equipment Category	**PM**	**Aldehydes**	**Benzene**	**1,3 But.**	**Gas. Vap.**	**SOx**
Lawn & Garden	8,060	4,459	12,308	4,967	84,326	4,161
Airport Service	11,679	529	464	234	315	6,892
Recreational	12,466	1,481	10,418	4,451	17,275	579
Recreational Marine	73,714	8,840	36,087	15,496	92,718	9,146
Light Commercial	3,662	1,468	2,711	1,032	24,424	4,366
Industrial	19,065	4,037	2,169	969	7,081	11,901
Construction	121,312	18,844	4,326	2,227	4,578	89,303
Agricultural	171,682	28,257	6,085	3,176	4,441	73,063
Logging	10,132	1,522	525	231	1,889	6,481
Marine Vessels	16,204	ND	ND	ND	ND	24,604
Nonroad Engines and Vehicles	447,976	69,438	75,092	32,783	237,048	230,495
Highway Vehicles	1,397,738	ND	ND	ND	ND	652,572
Other Area and Point Sources	6,384,620	ND	ND	ND	ND	22,311,998
All Sources	8,230,334	NA	NA	NA	NA	23,195,065

USA Inventory A
Emission Inventory Summary - Air Toxics and SOx
Percent of Total Inventory

	% total tpy					
Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
Lawn & Garden	0.10%	NA	NA	NA	NA	0.02%
Airport Service	0.14%	NA	NA	NA	NA	0.03%
Recreational	0.15%	NA	NA	NA	NA	0.00%
Recreational Marine	0.90%	NA	NA	NA	NA	0.04%
Light Commercial	0.04%	NA	NA	NA	NA	0.02%
Industrial	0.23%	NA	NA	NA	NA	0.05%
Construction	1.47%	NA	NA	NA	NA	0.39%
Agricultural	2.09%	NA	NA	NA	NA	0.31%
Logging	0.12%	NA	NA	NA	NA	0.03%
Marine Vessels	0.20%	NA	NA	NA	NA	0.11%
Nonroad Engines and Vehicles	5.44%	NA	NA	NA	NA	0.99%
Highway Vehicles	16.98%	NA	NA	NA	NA	2.81%
Other Area and Point Sources	77.57%	NA	NA	NA	NA	96.19%
All Sources	100.00%	NA	NA	NA	NA	100.00%

Atlanta MSA Inventory A
Emission Inventory Summary - VOC, NOx, CO

	tpy			tpsd		tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	6,614	326	51,197	23	1	40
Airport Service	311	2,073	2,518	1	6	7
Recreational	391	11	1,380	2	0	3
Recreational Marine	5,395	354	14,880	28	2	11
Light Commercial	1,275	320	16,656	4	1	46
Industrial	517	1,578	7,243	1	4	20
Construction	2,040	14,205	11,592	7	51	25
Agricultural	342	1,560	1,554	1	6	1
Logging	155	1	468	0	0	1
Marine Vessels	0	0	ND	0	0	ND
Nonroad Engines and Vehicles	17,041	20,427	107,487	68	71	154
Highway Vehicles	ND	69,146	ND	319	208	ND
Other Area and Point Sources	ND	92,553	ND	287	248	ND
All Sources	NA	182,126	NA	674	528	NA

Atlanta MSA Inventory A
Emission Inventory Summary - VOC, NOx, CO
Percent of Total Inventory

	% total tpy			% total tpsd		% total tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	NA	0.18%	NA	3.46%	0.23%	NA
Airport Service	NA	1.14%	NA	0.13%	1.08%	NA
Recreational	NA	0.01%	NA	0.22%	0.01%	NA
Recreational Marine	NA	0.19%	NA	4.18%	0.35%	NA
Light Commercial	NA	0.18%	NA	0.53%	0.17%	NA
Industrial	NA	0.87%	NA	0.22%	0.82%	NA
Construction	NA	7.80%	NA	1.10%	9.73%	NA
Agricultural	NA	0.86%	NA	0.19%	1.10%	NA
Logging	NA	0.00%	NA	0.06%	0.00%	NA
Marine Vessels	NA	0.00%	NA	0.00%	0.00%	NA
Nonroad Engines and Vehicles	NA	11.22%	NA	10.09%	13.49%	NA
Highway Vehicles	NA	37.97%	NA	47.32%	39.48%	NA
Other Area and Point Sources	NA	50.82%	NA	42.60%	47.03%	NA
All Sources	NA	100.00%	NA	100.00%	100.00%	NA

Atlanta MSA Inventory A
Emission Inventory Summary - Air Toxics and SOx

Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
	tpy					
Lawn & Garden	115	64	179	72	1,068	58
Airport Service	232	11	9	5	6	137
Recreational	4	2	11	5	43	1
Recreational Marine	316	36	153	66	348	38
Light Commercial	48	16	35	14	209	38
Industrial	127	27	15	6	46	79
Construction	1,669	260	60	31	63	1,236
Agricultural	286	47	10	5	7	122
Logging	3	1	4	2	17	0
Marine Vessels	ND	ND	ND	ND	ND	ND
Nonroad Engines and Vehicles	2,801	464	476	205	1,807	1,709
Highway Vehicles	ND	ND	ND	ND	ND	ND
Other Area and Point Sources	ND	ND	ND	ND	ND	ND
All Sources	NA	NA	NA	NA	NA	NA

Atlanta MSA Inventory A
Emission Inventory Summary - Air Toxics and SOx
Percent of Total Inventory

Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
	% total tpy					
Lawn & Garden	NA	NA	NA	NA	NA	NA
Airport Service	NA	NA	NA	NA	NA	NA
Recreational	NA	NA	NA	NA	NA	NA
Recreational Marine	NA	NA	NA	NA	NA	NA
Light Commercial	NA	NA	NA	NA	NA	NA
Industrial	NA	NA	NA	NA	NA	NA
Construction	NA	NA	NA	NA	NA	NA
Agricultural	NA	NA	NA	NA	NA	NA
Logging	NA	NA	NA	NA	NA	NA
Marine Vessels	NA	NA	NA	NA	NA	NA
Nonroad Engines and Vehicles	NA	NA	NA	NA	NA	NA
Highway Vehicles	NA	NA	NA	NA	NA	NA
Other Area and Point Sources	NA	NA	NA	NA	NA	NA
All Sources	NA	NA	NA	NA	NA	NA

Baltimore MSA Inventory A
Emission Inventory Summary - VOC, NOx, CO

	tpy			tped		tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	4,037	206	31,419	16	1	19
Airport Service	295	1,962	2,388	1	5	7
Recreational	646	12	1,303	1	0	9
Recreational Marine	2,170	250	7,701	13	2	2
Light Commercial	1,016	235	12,725	3	1	35
Industrial	451	1,387	6,342	1	4	17
Construction	1,329	9,286	7,513	6	39	12
Agricultural	451	2,045	2,036	2	9	1
Logging	80	0	242	0	0	1
Marine Vessels	1,623	5,970	30,332	4	16	83
Nonroad Engines and Vehicles	12,097	21,353	102,001	47	76	186
Highway Vehicles	ND	54,317	ND	200	164	1,328
Other Area and Point Sources	ND	59,976	34,462	226	164	226
All Sources	NA	135,646	NA	473	404	1,739

Baltimore MSA Inventory A
Emission Inventory Summary - VOC, NOx, CO
Percent of Total Inventory

	% total tpy			% total tped		% total tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	NA	0.15%	NA	3.38%	0.22%	1.11%
Airport Service	NA	1.45%	NA	0.17%	1.33%	0.38%
Recreational	NA	0.01%	NA	0.16%	0.01%	0.50%
Recreational Marine	NA	0.18%	NA	2.73%	0.39%	0.10%
Light Commercial	NA	0.17%	NA	0.60%	0.16%	2.00%
Industrial	NA	1.02%	NA	0.27%	0.94%	1.00%
Construction	NA	6.85%	NA	1.17%	9.56%	0.71%
Agricultural	NA	1.51%	NA	0.42%	2.22%	0.08%
Logging	NA	0.00%	NA	0.05%	0.00%	0.04%
Marine Vessels	NA	4.40%	NA	0.94%	4.05%	4.78%
Nonroad Engines and Vehicles	NA	15.74%	NA	9.88%	18.87%	10.70%
Highway Vehicles	NA	40.04%	NA	42.31%	40.49%	76.32%
Other Area and Point Sources	NA	44.22%	NA	47.81%	40.64%	12.98%
All Sources	NA	100.00%	NA	100.00%	100.00%	100.00%

Baltimore MSA Inventory A
Emission Inventory Summary - Air Toxics and SOx

Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
	tpy					
Lawn & Garden	70	39	106	43	734	36
Airport Service	220	10	9	4	6	130
Recreational	22	3	19	8	31	1
Recreational Marine	104	19	54	23	384	21
Light Commercial	37	13	28	11	156	28
Industrial	111	24	13	6	41	69
Construction	1,097	170	39	20	41	808
Agricultural	375	62	13	7	10	160
Logging	2	1	2	1	9	0
Marine Vessels	302	ND	ND	ND	ND	1,719
Nonroad Engines and Vehicles	2,340	340	284	124	1,412	2,971
Highway Vehicles	ND	ND	ND	ND	ND	ND
Other Area and Point Sources	ND	ND	ND	ND	ND	ND
All Sources	NA	NA	NA	NA	NA	NA

Baltimore MSA Inventory A
Emission Inventory Summary - Air Toxics and SOx
Percent of Total Inventory

Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
	% total tpy					
Lawn & Garden	NA	NA	NA	NA	NA	NA
Airport Service	NA	NA	NA	NA	NA	NA
Recreational	NA	NA	NA	NA	NA	NA
Recreational Marine	NA	NA	NA	NA	NA	NA
Light Commercial	NA	NA	NA	NA	NA	NA
Industrial	NA	NA	NA	NA	NA	NA
Construction	NA	NA	NA	NA	NA	NA
Agricultural	NA	NA	NA	NA	NA	NA
Logging	NA	NA	NA	NA	NA	NA
Marine Vessels	NA	NA	NA	NA	NA	NA
Nonroad Engines and Vehicles	NA	NA	NA	NA	NA	NA
Highway Vehicles	NA	NA	NA	NA	NA	NA
Other Area and Point Sources	NA	NA	NA	NA	NA	NA
All Sources	NA	NA	NA	NA	NA	NA

Baton Rouge CMSA Inventory A
Emission Inventory Summary - VOC, NOx, CO

	tpy			tpsd		tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	1,062	60	9,148	4	0	7
Airport Service	227	1,510	1,833	1	4	5
Recreational	334	9	1,180	1	0	2
Recreational Marine	2,737	108	5,799	14	1	4
Light Commercial	513	129	6,698	1	0	18
Industrial	129	394	1,806	0	1	5
Construction	1,016	7,075	5,774	4	26	13
Agricultural	113	518	516	0	2	0
Logging	27	129	190	0	0	1
Marine Vessels	108	1,849	394	0	5	1
Nonroad Engines and Vehicles	6,267	11,782	33,337	26	39	55
Highway Vehicles	ND	14,555	ND	64	44	ND
Other Area and Point Sources	ND	82,744	ND	270	227	ND
All Sources	NA	109,081	NA	360	310	NA

Baton Rouge CMSA Inventory A
Emission Inventory Summary - VOC, NOx, CO
Percent of Total Inventory

	% total tpy			% total tpsd		% total tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	NA	0.05%	NA	1.07%	0.07%	NA
Airport Service	NA	1.38%	NA	0.17%	1.34%	NA
Recreational	NA	0.01%	NA	0.38%	0.01%	NA
Recreational Marine	NA	0.10%	NA	3.97%	0.18%	NA
Light Commercial	NA	0.12%	NA	0.40%	0.11%	NA
Industrial	NA	0.36%	NA	0.10%	0.35%	NA
Construction	NA	6.49%	NA	1.02%	8.26%	NA
Agricultural	NA	0.47%	NA	0.12%	0.62%	NA
Logging	NA	0.12%	NA	0.02%	0.11%	NA
Marine Vessels	NA	1.70%	NA	0.08%	1.63%	NA
Nonroad Engines and Vehicles	NA	10.80%	NA	7.33%	12.69%	NA
Highway Vehicles	NA	13.34%	NA	17.76%	14.15%	NA
Other Area and Point Sources	NA	75.86%	NA	74.91%	73.15%	NA
All Sources	NA	100.00%	NA	100.00%	100.00%	NA

Baton Rouge CMSA Inventory A
Emission Inventory Summary - Air Toxics and SOx

Equipment Category	PM	Aldehydes	Benzene	tpy 1,3 But.	Gas. Vap.	SOx
Lawn & Garden	19	11	29	11	179	11
Airport Service	169	8	7	3	4	100
Recreational	3	2	9	4	37	1
Recreational Marine	170	14	79	34	134	15
Light Commercial	19	7	14	6	84	15
Industrial	32	7	4	2	12	20
Construction	832	130	30	15	31	616
Agricultural	95	16	3	2	2	40
Logging	17	2	1	0	3	11
Marine Vessels	109	ND	ND	ND	ND	739
Nonroad Engines and Vehicles	1,466	195	175	77	486	1,568
Highway Vehicles	ND	ND	ND	ND	ND	ND
Other Area and Point Sources	ND	ND	ND	ND	ND	ND
All Sources	NA	NA	NA	NA	NA	NA

Baton Rouge CMSA Inventory A
Emission Inventory Summary - Air Toxics and SOx
Percent of Total Inventory

Equipment Category	PM	Aldehydes	Benzene	% total tpy 1,3 But.	Gas. Vap.	SOx
Lawn & Garden	NA	NA	NA	NA	NA	NA
Airport Service	NA	NA	NA	NA	NA	NA
Recreational	NA	NA	NA	NA	NA	NA
Recreational Marine	NA	NA	NA	NA	NA	NA
Light Commercial	NA	NA	NA	NA	NA	NA
Industrial	NA	NA	NA	NA	NA	NA
Construction	NA	NA	NA	NA	NA	NA
Agricultural	NA	NA	NA	NA	NA	NA
Logging	NA	NA	NA	NA	NA	NA
Marine Vessels	NA	NA	NA	NA	NA	NA
Nonroad Engines and Vehicles	NA	NA	NA	NA	NA	NA
Highway Vehicles	NA	NA	NA	NA	NA	NA
Other Area and Point Sources	NA	NA	NA	NA	NA	NA
All Sources	NA	NA	NA	NA	NA	NA

Boston CMSA Inventory A
Emission Inventory Summary - VOC, NOx, CO

	tpy			tpsd		tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	4,057	222	31,900	20	1	14
Airport Service	375	2,496	3,036	1	7	8
Recreational	2,961	51	5,388	2	0	44
Recreational Marine	2,066	134	5,528	14	1	1
Light Commercial	2,427	519	29,277	7	1	80
Industrial	1,415	4,400	20,037	4	12	55
Construction	1,683	11,807	9,439	8	56	10
Agricultural	121	546	543	1	3	0
Logging	59	0	178	0	0	0
Marine Vessels	ND	ND	ND	0	5	1
Nonroad Engines and Vehicles	15,166	20,176	105,326	58	86	214
Highway Vehicles	ND	ND	ND	415	207	1,470
Other Area and Point Sources	ND	ND	ND	304	169	599
All Sources	NA	NA	NA	777	462	2,282

Boston CMSA Inventory A
Emission Inventory Summary - VOC, NOx, CO
Percent of Total Inventory

	% total tpy			% total tpsd		% total tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	NA	NA	NA	2.62%	0.26%	0.59%
Airport Service	NA	NA	NA	0.13%	1.48%	0.36%
Recreational	NA	NA	NA	0.30%	0.01%	1.94%
Recreational Marine	NA	NA	NA	1.83%	0.22%	0.03%
Light Commercial	NA	NA	NA	0.87%	0.31%	3.51%
Industrial	NA	NA	NA	0.51%	2.61%	2.41%
Construction	NA	NA	NA	1.02%	12.05%	0.45%
Agricultural	NA	NA	NA	0.09%	0.65%	0.02%
Logging	NA	NA	NA	0.02%	0.00%	0.02%
Marine Vessels	NA	NA	NA	0.03%	1.07%	0.03%
Nonroad Engines and Vehicles	NA	NA	NA	7.42%	18.66%	9.36%
Highway Vehicles	NA	NA	NA	53.40%	44.82%	64.42%
Other Area and Point Sources	NA	NA	NA	39.18%	36.52%	26.23%
All Sources	NA	NA	NA	100.00%	100.00%	100.00%

Boston CMSA Inventory A
Emission Inventory Summary - Air Toxics and SOx

Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
	tpy					
Lawn & Garden	70	39	102	41	884	38
Airport Service	280	13	11	6	8	165
Recreational	113	12	86	37	108	4
Recreational Marine	101	13	50	22	411	13
Light Commercial	88	30	67	27	351	62
Industrial	352	74	40	18	133	220
Construction	1,405	217	49	26	53	1,026
Agricultural	100	17	4	2	3	43
Logging	1	1	2	1	6	0
Marine Vessels	173	ND	ND	ND	ND	ND
Nonroad Engines and Vehicles	2,682	415	412	178	1,956	1,572
Highway Vehicles	ND	ND	ND	ND	ND	ND
Other Area and Point Sources	ND	ND	ND	ND	ND	ND
All Sources	NA	NA	NA	NA	NA	NA

Boston CMSA Inventory A
Emission Inventory Summary - Air Toxics and SOx
Percent of Total Inventory

Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
	% total tpy					
Lawn & Garden	NA	NA	NA	NA	NA	NA
Airport Service	NA	NA	NA	NA	NA	NA
Recreational	NA	NA	NA	NA	NA	NA
Recreational Marine	NA	NA	NA	NA	NA	NA
Light Commercial	NA	NA	NA	NA	NA	NA
Industrial	NA	NA	NA	NA	NA	NA
Construction	NA	NA	NA	NA	NA	NA
Agricultural	NA	NA	NA	NA	NA	NA
Logging	NA	NA	NA	NA	NA	NA
Marine Vessels	NA	NA	NA	NA	NA	NA
Nonroad Engines and Vehicles	NA	NA	NA	NA	NA	NA
Highway Vehicles	NA	NA	NA	NA	NA	NA
Other Area and Point Sources	NA	NA	NA	NA	NA	NA
All Sources	NA	NA	NA	NA	NA	NA

Chicago CMSA Inventory A
Emission Inventory Summary - VOC, NOx, CO

	tpy			tpsd		tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	7,364	414	58,955	37	2	25
Airport Service	761	5,063	6,153	2	14	17
Recreational	4,411	76	8,022	4	0	64
Recreational Marine	2,880	131	6,239	20	1	0
Light Commercial	4,099	876	49,400	11	2	135
Industrial	2,723	8,447	38,503	8	23	105
Construction	3,452	24,210	19,352	16	114	21
Agricultural	759	3,408	3,392	4	19	2
Logging	85	0	255	0	0	1
Marine Vessels	ND	608	ND	1	26	ND
Nonroad Engines and Vehicles	26,534	43,233	190,271	104	202	372
Highway Vehicles	ND	153,215	ND	588	462	ND
Other Area and Point Sources	ND	302,107	ND	1,029	603	ND
All Sources	NA	498,555	NA	1,721	1,267	NA

Chicago CMSA Inventory A
Emission Inventory Summary - VOC, NOx, CO
Percent of Total Inventory

	% total tpy			% total tpsd		% total tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	NA	0.08%	NA	2.14%	0.18%	NA
Airport Service	NA	1.02%	NA	0.12%	1.10%	NA
Recreational	NA	0.02%	NA	0.22%	0.01%	NA
Recreational Marine	NA	0.03%	NA	1.19%	0.08%	NA
Light Commercial	NA	0.18%	NA	0.66%	0.19%	NA
Industrial	NA	1.69%	NA	0.45%	1.83%	NA
Construction	NA	4.86%	NA	0.94%	9.01%	NA
Agricultural	NA	0.68%	NA	0.24%	1.47%	NA
Logging	NA	0.00%	NA	0.01%	0.00%	NA
Marine Vessels	NA	0.12%	NA	0.07%	2.09%	NA
Nonroad Engines and Vehicles	NA	8.67%	NA	6.04%	15.94%	NA
Highway Vehicles	NA	30.73%	NA	34.16%	36.45%	NA
Other Area and Point Sources	NA	60.60%	NA	59.80%	47.60%	NA
All Sources	NA	100.00%	NA	100.00%	100.00%	NA

Chicago CMSA Inventory A
Emission Inventory Summary - Air Toxics and SOx

	tpy					
Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
Lawn & Garden	128	71	184	74	1,658	71
Airport Service	567	26	23	11	16	335
Recreational	168	17	129	55	164	7
Recreational Marine	148	15	71	30	546	16
Light Commercial	148	51	114	46	596	105
Industrial	674	143	76	34	260	421
Construction	2,882	446	101	52	110	2,104
Agricultural	624	103	22	12	20	266
Logging	2	1	2	1	9	0
Marine Vessels	300	ND	ND	ND	ND	ND
Nonroad Engines and Vehicles	5,643	872	722	316	3,378	3,325
Highway Vehicles	113,525	ND	ND	ND	ND	ND
Other Area and Point Sources	181,246	ND	ND	ND	ND	ND
All Sources	300,414	NA	NA	NA	NA	NA

Chicago CMSA Inventory A
Emission Inventory Summary - Air Toxics and SOx
Percent of Total Inventory

	% total tpy					
Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
Lawn & Garden	0.04%	NA	NA	NA	NA	NA
Airport Service	0.19%	NA	NA	NA	NA	NA
Recreational	0.06%	NA	NA	NA	NA	NA
Recreational Marine	0.05%	NA	NA	NA	NA	NA
Light Commercial	0.05%	NA	NA	NA	NA	NA
Industrial	0.22%	NA	NA	NA	NA	NA
Construction	0.96%	NA	NA	NA	NA	NA
Agricultural	0.21%	NA	NA	NA	NA	NA
Logging	0.00%	NA	NA	NA	NA	NA
Marine Vessels	0.10%	NA	NA	NA	NA	NA
Nonroad Engines and Vehicles	1.88%	NA	NA	NA	NA	NA
Highway Vehicles	37.79%	NA	NA	NA	NA	NA
Other Area and Point Sources	60.33%	NA	NA	NA	NA	NA
All Sources	100.00%	NA	NA	NA	NA	NA

Cleveland CMSA Inventory A
Emission Inventory Summary - VOC, NOx, CO

	tpy			tpsd		tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	2,773	155	22,142	14	1	9
Airport Service	323	2,151	2,608	1	6	7
Recreational	668	11	1,215	1	0	10
Recreational Marine	1,265	110	3,529	9	1	0
Light Commercial	1,643	351	19,802	5	1	54
Industrial	1,272	3,945	17,982	4	11	49
Construction	1,185	8,313	6,645	6	39	7
Agricultural	345	1,551	1,544	2	9	1
Logging	33	0	99	0	0	0
Marine Vessels	1,003	109	3,757	3	0	ND
Nonroad Engines and Vehicles	10,510	16,697	79,323	43	67	138
Highway Vehicles	ND	64,808	412,340	242	195	2,360
Other Area and Point Sources	ND	62,301	88,401	369	171	252
All Sources	NA	143,806	580,084	653	433	2,750

Cleveland CMSA Inventory A
Emission Inventory Summary - VOC, NOx, CO
Percent of Total Inventory

	% total tpy			% total tpsd		% total tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	NA	0.11%	3.82%	2.12%	0.19%	0.34%
Airport Service	NA	1.50%	0.45%	0.14%	1.36%	0.26%
Recreational	NA	0.01%	0.21%	0.09%	0.00%	0.36%
Recreational Marine	NA	0.08%	0.61%	1.36%	0.20%	0.00%
Light Commercial	NA	0.24%	3.41%	0.70%	0.22%	1.97%
Industrial	NA	2.74%	3.10%	0.55%	2.49%	1.79%
Construction	NA	5.78%	1.15%	0.85%	9.04%	0.26%
Agricultural	NA	1.08%	0.27%	0.29%	1.96%	0.04%
Logging	NA	0.00%	0.02%	0.01%	0.00%	0.01%
Marine Vessels	NA	0.08%	0.65%	0.42%	0.07%	0.00%
Nonroad Engines and Vehicles	NA	11.61%	13.67%	6.52%	15.54%	5.04%
Highway Vehicles	NA	45.07%	71.09%	37.00%	45.07%	85.81%
Other Area and Point Sources	NA	43.32%	15.24%	56.47%	39.39%	9.15%
All Sources	NA	100.00%	100.00%	100.00%	100.00%	100.00%

Cleveland CMSA Inventory A
Emission Inventory Summary - Air Toxics and SOx

				tpy		
Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
Lawn & Garden	48	27	69	28	623	27
Airport Service	241	11	10	5	7	142
Recreational	25	3	19	8	25	1
Recreational Marine	60	9	30	13	277	10
Light Commercial	59	20	46	18	239	42
Industrial	315	67	36	16	121	197
Construction	990	153	35	18	38	723
Agricultural	284	47	10	5	9	121
Logging	1	0	1	0	4	0
Marine Vessels	ND	ND	ND	ND	ND	ND
Nonroad Engines and Vehicles	2,024	336	255	112	1,342	1,262
Highway Vehicles	46,729	ND	ND	ND	ND	ND
Other Area and Point Sources	64,287	ND	ND	ND	ND	ND
All Sources	113,040	NA	NA	NA	NA	NA

Cleveland CMSA Inventory A
Emission Inventory Summary - Air Toxics and SOx
Percent of Total Inventory

				% total tpy		
Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
Lawn & Garden	0.04%	NA	NA	NA	NA	NA
Airport Service	0.21%	NA	NA	NA	NA	NA
Recreational	0.02%	NA	NA	NA	NA	NA
Recreational Marine	0.05%	NA	NA	NA	NA	NA
Light Commercial	0.05%	NA	NA	NA	NA	NA
Industrial	0.28%	NA	NA	NA	NA	NA
Construction	0.88%	NA	NA	NA	NA	NA
Agricultural	0.25%	NA	NA	NA	NA	NA
Logging	0.00%	NA	NA	NA	NA	NA
Marine Vessels	0.00%	NA	NA	NA	NA	NA
Nonroad Engines and Vehicles	1.79%	NA	NA	NA	NA	NA
Highway Vehicles	41.34%	NA	NA	NA	NA	NA
Other Area and Point Sources	56.87%	NA	NA	NA	NA	NA
All Sources	100.00%	NA	NA	NA	NA	NA

Denver CMSA Inventory A
Emission Inventory Summary - VOC, NOx, CO

Equipment Category	tpy VOC	tpy NOx	tpy CO	tpsd VOC	tpsd NOx	tpwd CO
Lawn & Garden	3,818	225	32,741	20	1	10
Airport Service	239	1,591	1,931	1	4	5
Recreational	1,892	33	3,601	2	0	27
Recreational Marine	1,124	77	3,402	8	1	0
Light Commercial	2,010	465	25,138	6	1	69
Industrial	721	2,217	10,138	2	6	28
Construction	1,768	12,377	10,010	8	58	11
Agricultural	196	895	876	1	5	1
Logging	31	0	93	0	0	0
Marine Vessels	ND	ND	0	ND	ND	0
Nonroad Engines and Vehicles	11,801	17,880	87,931	47	77	150
Highway Vehicles	ND	ND	417,406	ND	ND	2,371
Other Area and Point Sources	ND	ND	58,870	ND	ND	168
All Sources	NA	NA	564,207	NA	NA	2,689

Denver CMSA Inventory A
Emission Inventory Summary - VOC, NOx, CO
Percent of Total Inventory

Equipment Category	% total tpy VOC	% total tpy NOx	% total tpy CO	% total tpsd VOC	% total tpsd NOx	% total tpwd CO
Lawn & Garden	NA	NA	5.80%	NA	NA	0.35%
Airport Service	NA	NA	0.34%	NA	NA	0.20%
Recreational	NA	NA	0.64%	NA	NA	0.99%
Recreational Marine	NA	NA	0.60%	NA	NA	0.00%
Light Commercial	NA	NA	4.46%	NA	NA	2.56%
Industrial	NA	NA	1.80%	NA	NA	1.03%
Construction	NA	NA	1.77%	NA	NA	0.41%
Agricultural	NA	NA	0.16%	NA	NA	0.02%
Logging	NA	NA	0.02%	NA	NA	0.01%
Marine Vessels	NA	NA	0.00%	NA	NA	0.00%
Nonroad Engines and Vehicles	NA	NA	15.58%	NA	NA	5.57%
Highway Vehicles	NA	NA	73.98%	NA	NA	88.20%
Other Area and Point Sources	NA	NA	10.43%	NA	NA	6.23%
All Sources	NA	NA	100.00%	NA	NA	100.00%

Denver CMSA Inventory A
Emission Inventory Summary - Air Toxics and SOx

Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
	tpy					
Lawn & Garden	68	39	98	39	790	39
Airport Service	178	8	7	4	5	105
Recreational	69	8	55	24	77	3
Recreational Marine	60	8	30	13	132	8
Light Commercial	74	25	56	22	310	55
Industrial	178	38	20	9	67	111
Construction	1,463	227	52	27	55	1,077
Agricultural	164	27	6	3	4	70
Logging	1	0	1	0	3	0
Marine Vessels	ND	ND	ND	ND	ND	ND
Nonroad Engines and Vehicles	2,256	380	324	141	1,444	1,467
Highway Vehicles	32,716	ND	ND	ND	ND	ND
Other Area and Point Sources	146,677	ND	ND	ND	ND	ND
All Sources	181,649	NA	NA	NA	NA	NA

Denver CMSA Inventory A
Emission Inventory Summary - Air Toxics and SOx
Percent of Total Inventory

Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
	% total tpy					
Lawn & Garden	0.04%	NA	NA	NA	NA	NA
Airport Service	0.10%	NA	NA	NA	NA	NA
Recreational	0.04%	NA	NA	NA	NA	NA
Recreational Marine	0.03%	NA	NA	NA	NA	NA
Light Commercial	0.04%	NA	NA	NA	NA	NA
Industrial	0.10%	NA	NA	NA	NA	NA
Construction	0.81%	NA	NA	NA	NA	NA
Agricultural	0.09%	NA	NA	NA	NA	NA
Logging	0.00%	NA	NA	NA	NA	NA
Marine Vessels	0.00%	NA	NA	NA	NA	NA
Nonroad Engines and Vehicles	1.24%	NA	NA	NA	NA	NA
Highway Vehicles	18.01%	NA	NA	NA	NA	NA
Other Area and Point Sources	80.75%	NA	NA	NA	NA	NA
All Sources	100.00%	NA	NA	NA	NA	NA

El Paso MSA Inventory A
Emission Inventory Summary - VOC, NOx, CO

	tpy			tpsd		tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	825	48	7,316	3	0	5
Airport Service	71	470	575	0	1	2
Recreational	301	8	1,053	1	0	1
Recreational Marine	0	0	0	0	0	0
Light Commercial	501	129	6,598	1	0	18
Industrial	260	795	3,645	1	2	10
Construction	476	3,295	2,719	2	12	6
Agricultural	39	179	176	0	1	0
Logging	5	0	14	0	0	0
Marine Vessels	0	0	0	0	0	0
Nonroad Engines and Vehicles	2,477	4,925	22,097	8	17	42
Highway Vehicles	ND	11,156	320,700	36	34	756
Other Area and Point Sources	ND	20,382	18,000	60	25	24
All Sources	NA	36,463	360,797	105	75	822

El Paso MSA Inventory A
Emission Inventory Summary - VOC, NOx, CO
Percent of Total Inventory

	% total tpy			% total tpsd		% total tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	NA	0.13%	2.03%	2.92%	0.24%	0.61%
Airport Service	NA	1.29%	0.16%	0.19%	1.71%	0.19%
Recreational	NA	0.02%	0.29%	1.17%	0.04%	0.17%
Recreational Marine	NA	0.00%	0.00%	0.00%	0.00%	0.00%
Light Commercial	NA	0.35%	1.83%	1.33%	0.47%	2.20%
Industrial	NA	2.18%	1.01%	0.70%	2.90%	1.21%
Construction	NA	9.04%	0.75%	1.65%	15.87%	0.72%
Agricultural	NA	0.49%	0.05%	0.14%	0.89%	0.01%
Logging	NA	0.00%	0.00%	0.01%	0.00%	0.00%
Marine Vessels	NA	0.00%	0.00%	0.00%	0.00%	0.00%
Nonroad Engines and Vehicles	NA	13.51%	6.12%	8.10%	22.12%	5.13%
Highway Vehicles	NA	30.60%	88.89%	34.64%	44.76%	91.92%
Other Area and Point Sources	NA	55.90%	4.99%	57.26%	33.11%	2.96%
All Sources	NA	100.00%	100.00%	100.00%	100.00%	100.00%

El Paso MSA Inventory A
Emission Inventory Summary - Air Toxics and SOx

	tpy					
Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
Lawn & Garden	16	9	22	9	142	8
Airport Service	53	2	2	1	1	31
Recreational	3	2	8	3	34	1
Recreational Marine	0	0	0	0	0	0
Light Commercial	19	6	14	6	81	15
Industrial	64	14	7	3	23	40
Construction	389	61	14	7	15	287
Agricultural	33	5	1	1	1	14
Logging	0	0	0	0	0	0
Marine Vessels	0	0	ND	ND	ND	0
Nonroad Engines and Vehicles	577	99	69	30	296	396
Highway Vehicles	7,278	ND	ND	ND	ND	ND
Other Area and Point Sources	129,939	ND	ND	ND	ND	ND
All Sources	137,794	NA	NA	NA	NA	NA

El Paso MSA Inventory A
Emission Inventory Summary - Air Toxics and SOx
Percent of Total Inventory

	% total tpy					
Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
Lawn & Garden	0.01%	NA	NA	NA	NA	NA
Airport Service	0.04%	NA	NA	NA	NA	NA
Recreational	0.00%	NA	NA	NA	NA	NA
Recreational Marine	0.00%	NA	NA	NA	NA	NA
Light Commercial	0.01%	NA	NA	NA	NA	NA
Industrial	0.05%	NA	NA	NA	NA	NA
Construction	0.28%	NA	NA	NA	NA	NA
Agricultural	0.02%	NA	NA	NA	NA	NA
Logging	0.00%	NA	NA	NA	NA	NA
Marine Vessels	0.00%	NA	NA	NA	NA	NA
Nonroad Engines and Vehicles	0.42%	NA	NA	NA	NA	NA
Highway Vehicles	5.28%	NA	NA	NA	NA	NA
Other Area and Point Sources	94.30%	NA	NA	NA	NA	NA
All Sources	100.00%	NA	NA	NA	NA	NA

Hartford NECMA Inventory A
Emission Inventory Summary - VOC, NOx, CO

	tpy			tpsd		tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	1,545	75	11,037	8	0	5
Airport Service	270	1,800	2,188	1	5	6
Recreational	1,278	22	2,325	1	0	19
Recreational Marine	1,939	122	4,853	13	1	1
Light Commercial	594	127	7,165	2	0	20
Industrial	519	1,612	7,342	1	4	20
Construction	623	4,370	3,494	3	21	4
Agricultural	105	471	468	1	3	0
Logging	39	0	117	0	0	0
Marine Vessels	11	260	29	0	1	0
Nonroad Engines and Vehicles	6,923	8,859	39,018	30	35	74
Highway Vehicles	ND	29,311	108,380	189	88	590
Other Area and Point Sources	ND	11,650	51,997	77	18	210
All Sources	NA	49,820	199,395	295	141	874

Hartford NECMA Inventory A
Emission Inventory Summary - VOC, NOx, CO
Percent of Total Inventory

	% total tpy			% total tpsd		% total tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	NA	0.15%	5.54%	2.65%	0.28%	0.52%
Airport Service	NA	3.61%	1.10%	0.25%	3.49%	0.69%
Recreational	NA	0.04%	1.17%	0.34%	0.02%	2.18%
Recreational Marine	NA	0.25%	2.43%	4.56%	0.65%	0.06%
Light Commercial	NA	0.26%	3.59%	0.56%	0.25%	2.25%
Industrial	NA	3.24%	3.68%	0.49%	3.13%	2.30%
Construction	NA	8.77%	1.75%	0.99%	14.57%	0.44%
Agricultural	NA	0.94%	0.23%	0.19%	1.82%	0.04%
Logging	NA	0.00%	0.06%	0.04%	0.00%	0.04%
Marine Vessels	NA	0.52%	0.01%	0.01%	0.50%	0.01%
Nonroad Engines and Vehicles	NA	17.78%	19.57%	10.09%	24.71%	8.51%
Highway Vehicles	NA	58.83%	54.35%	63.87%	62.50%	67.48%
Other Area and Point Sources	NA	23.38%	26.08%	26.04%	12.79%	24.02%
All Sources	NA	100.00%	100.00%	100.00%	100.00%	100.00%

Hartford NECMA Inventory A

Emission Inventory Summary - Air Toxics and SOx

Equipment Category	PM	Aldehydes	Benzene	tpy 1,3 But.	Gas. Vap.	SOx
Lawn & Garden	25	14	39	16	318	13
Airport Service	202	9	8	4	6	119
Recreational	49	5	37	16	46	2
Recreational Marine	99	12	48	21	352	13
Light Commercial	22	7	17	7	86	15
Industrial	129	27	15	6	49	80
Construction	520	80	18	9	20	380
Agricultural	86	14	3	2	3	37
Logging	1	0	1	0	4	0
Marine Vessels	ND	ND	ND	ND	ND	ND
Nonroad Engines and Vehicles	1,132	169	186	81	883	659
Highway Vehicles	ND	ND	ND	ND	ND	ND
Other Area and Point Sources	ND	ND	ND	ND	ND	ND
All Sources	NA	NA	NA	NA	NA	NA

Hartford NECMA Inventory A

Emission Inventory Summary - Air Toxics and SOx

Percent of Total Inventory

Equipment Category	PM	Aldehydes	Benzene	% total tpy 1,3 But.	Gas. Vap.	SOx
Lawn & Garden	NA	NA	NA	NA	NA	NA
Airport Service	NA	NA	NA	NA	NA	NA
Recreational	NA	NA	NA	NA	NA	NA
Recreational Marine	NA	NA	NA	NA	NA	NA
Light Commercial	NA	NA	NA	NA	NA	NA
Industrial	NA	NA	NA	NA	NA	NA
Construction	NA	NA	NA	NA	NA	NA
Agricultural	NA	NA	NA	NA	NA	NA
Logging	NA	NA	NA	NA	NA	NA
Marine Vessels	NA	NA	NA	NA	NA	NA
Nonroad Engines and Vehicles	NA	NA	NA	NA	NA	NA
Highway Vehicles	NA	NA	NA	NA	NA	NA
Other Area and Point Sources	NA	NA	NA	NA	NA	NA
All Sources	NA	NA	NA	NA	NA	NA

Houston CMSA Inventory A
Emission Inventory Summary - VOC, NOx, CO

	tpy			tpsd		tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	10,605	598	91,170	39	2	64
Airport Service	411	2,739	3,331	1	8	9
Recreational	978	27	3,419	4	0	4
Recreational Marine	10,184	582	28,805	53	3	22
Light Commercial	4,518	1,166	59,504	13	3	163
Industrial	1,227	3,755	17,210	3	10	47
Construction	5,592	38,709	31,941	20	140	70
Agricultural	670	3,080	3,033	3	11	2
Logging	126	256	575	0	1	2
Marine Vessels	688	12,462	1,718	2	34	5
Nonroad Engines and Vehicles	34,999	63,373	240,707	138	213	388
Highway Vehicles	ND	100,865	ND	442	304	ND
Other Area and Point Sources	ND	440,925	ND	1,391	859	ND
All Sources	NA	605,163	NA	1,972	1,376	NA

Houston CMSA Inventory A
Emission Inventory Summary - VOC, NOx, CO
Percent of Total Inventory

	% total tpy			% total tpsd		% total tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	NA	0.10%	NA	1.98%	0.16%	NA
Airport Service	NA	0.45%	NA	0.06%	0.55%	NA
Recreational	NA	0.00%	NA	0.20%	0.01%	NA
Recreational Marine	NA	0.10%	NA	2.70%	0.22%	NA
Light Commercial	NA	0.19%	NA	0.64%	0.23%	NA
Industrial	NA	0.62%	NA	0.17%	0.75%	NA
Construction	NA	6.40%	NA	1.03%	10.17%	NA
Agricultural	NA	0.51%	NA	0.13%	0.83%	NA
Logging	NA	0.04%	NA	0.02%	0.05%	NA
Marine Vessels	NA	2.06%	NA	0.10%	2.48%	NA
Nonroad Engines and Vehicles	NA	10.47%	NA	7.01%	15.46%	NA
Highway Vehicles	NA	16.67%	NA	22.44%	22.09%	NA
Other Area and Point Sources	NA	72.86%	NA	70.55%	62.45%	NA
All Sources	NA	100.00%	NA	100.00%	100.00%	NA

Houston CMSA Inventory A
Emission Inventory Summary - Air Toxics and SOx

Equipment Category	PM	Aldehydes	Benzene	tpy 1,3 But.	Gas. Vap.	SOx
Lawn & Garden	199	111	285	115	1,798	105
Airport Service	307	14	12	6	8	181
Recreational	10	6	27	11	109	2
Recreational Marine	592	68	290	124	612	65
Light Commercial	173	58	124	50	729	138
Industrial	302	64	35	15	107	188
Construction	4,570	713	165	85	172	3,370
Agricultural	565	93	20	10	12	240
Logging	35	6	4	2	13	21
Marine Vessels	741	ND	ND	ND	ND	5,152
Nonroad Engines and Vehicles	7,493	1,133	961	418	3,560	9,464
Highway Vehicles	ND	ND	ND	ND	ND	ND
Other Area and Point Sources	ND	ND	ND	ND	ND	ND
All Sources	NA	NA	NA	NA	NA	NA

Houston CMSA Inventory A
Emission Inventory Summary - Air Toxics and SOx
Percent of Total Inventory

Equipment Category	PM	Aldehydes	Benzene	% total tpy 1,3 But.	Gas. Vap.	SOx
Lawn & Garden	NA	NA	NA	NA	NA	NA
Airport Service	NA	NA	NA	NA	NA	NA
Recreational	NA	NA	NA	NA	NA	NA
Recreational Marine	NA	NA	NA	NA	NA	NA
Light Commercial	NA	NA	NA	NA	NA	NA
Industrial	NA	NA	NA	NA	NA	NA
Construction	NA	NA	NA	NA	NA	NA
Agricultural	NA	NA	NA	NA	NA	NA
Logging	NA	NA	NA	NA	NA	NA
Marine Vessels	NA	NA	NA	NA	NA	NA
Nonroad Engines and Vehicles	NA	NA	NA	NA	NA	NA
Highway Vehicles	NA	NA	NA	NA	NA	NA
Other Area and Point Sources	NA	NA	NA	NA	NA	NA
All Sources	NA	NA	NA	NA	NA	NA

Miami CMSA Inventory A
Emission Inventory Summary - VOC, NOx, CO

	tpy			tpsd		tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	5,274	320	48,109	20	1	33
Airport Service	186	1,239	1,501	1	3	4
Recreational	684	19	2,414	3	0	4
Recreational Marine	7,000	646	20,920	36	3	16
Light Commercial	1,497	376	19,562	4	1	54
Industrial	682	2,079	9,543	2	6	26
Construction	1,673	11,655	9,511	6	42	21
Agricultural	172	783	780	1	3	1
Logging	27	0	81	0	0	0
Marine Vessels	943	1,310	ND	3	4	ND
Nonroad Engines and Vehicles	18,138	18,426	112,421	74	63	159
Highway Vehicles	ND	63,266	ND	307	191	ND
Other Area and Point Sources	ND	35,464	ND	235	97	ND
All Sources	NA	117,156	NA	616	351	NA

Miami CMSA Inventory A
Emission Inventory Summary - VOC, NOx, CO
Percent of Total Inventory

	% total tpy			% total tpsd		% total tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	NA	0.27%	NA	3.18%	0.34%	NA
Airport Service	NA	1.06%	NA	0.08%	0.97%	NA
Recreational	NA	0.02%	NA	0.43%	0.02%	NA
Recreational Marine	NA	0.55%	NA	5.89%	0.97%	NA
Light Commercial	NA	0.32%	NA	0.68%	0.29%	NA
Industrial	NA	1.77%	NA	0.31%	1.62%	NA
Construction	NA	9.95%	NA	0.98%	12.00%	NA
Agricultural	NA	0.67%	NA	0.10%	0.83%	NA
Logging	NA	0.00%	NA	0.01%	0.00%	NA
Marine Vessels	NA	1.12%	NA	0.42%	1.02%	NA
Nonroad Engines and Vehicles	NA	15.73%	NA	12.09%	18.06%	NA
Highway Vehicles	NA	54.00%	NA	49.78%	54.28%	NA
Other Area and Point Sources	NA	30.27%	NA	38.13%	27.66%	NA
All Sources	NA	100.00%	NA	100.00%	100.00%	NA

Miami CMSA Inventory A
Emission Inventory Summary - Air Toxics and SOx

Equipment Category	PM	Aldehydes	Benzene	tpy 1,3 But.	Gas. Vap.	SOx
Lawn & Garden	100	57	141	57	908	56
Airport Service	139	6	6	3	4	82
Recreational	7	4	19	8	76	2
Recreational Marine	391	51	191	82	707	60
Light Commercial	56	19	41	16	246	44
Industrial	167	35	19	9	61	104
Construction	1,370	213	49	25	52	1,014
Agricultural	144	24	5	3	3	61
Logging	1	0	1	0	3	0
Marine Vessels	ND	ND	ND	ND	ND	ND
Nonroad Engines and Vehicles	2,374	410	472	203	2,059	1,424
Highway Vehicles	ND	ND	ND	ND	ND	ND
Other Area and Point Sources	ND	ND	ND	ND	ND	ND
All Sources	NA	NA	NA	NA	NA	NA

Miami CMSA Inventory A
Emission Inventory Summary - Air Toxics and SOx
Percent of Total Inventory

Equipment Category	PM	Aldehydes	Benzene	% total tpy 1,3 But.	Gas. Vap.	SOx
Lawn & Garden	NA	NA	NA	NA	NA	NA
Airport Service	NA	NA	NA	NA	NA	NA
Recreational	NA	NA	NA	NA	NA	NA
Recreational Marine	NA	NA	NA	NA	NA	NA
Light Commercial	NA	NA	NA	NA	NA	NA
Industrial	NA	NA	NA	NA	NA	NA
Construction	NA	NA	NA	NA	NA	NA
Agricultural	NA	NA	NA	NA	NA	NA
Logging	NA	NA	NA	NA	NA	NA
Marine Vessels	NA	NA	NA	NA	NA	NA
Nonroad Engines and Vehicles	NA	NA	NA	NA	NA	NA
Highway Vehicles	NA	NA	NA	NA	NA	NA
Other Area and Point Sources	NA	NA	NA	NA	NA	NA
All Sources	NA	NA	NA	NA	NA	NA

Milwaukee CMSA Inventory A
Emission Inventory Summary - VOC, NOx, CO

	tpy			tpsd		tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	1,544	83	11,953	8	0	5
Airport Service	178	1,182	1,435	0	3	4
Recreational	747	13	1,358	1	0	11
Recreational Marine	2,227	184	4,472	16	1	0
Light Commercial	733	157	8,832	2	0	24
Industrial	619	1,919	8,749	2	5	24
Construction	595	4,174	3,336	3	20	4
Agricultural	344	1,547	1,540	2	8	1
Logging	24	0	72	0	0	0
Marine Vessels	457	398	ND	1	1	ND
Nonroad Engines and Vehicles	7,467	9,657	41,746	35	40	73
Highway Vehicles	ND	33,493	ND	106	101	ND
Other Area and Point Sources	ND	39,621	ND	195	109	ND
All Sources	NA	82,771	NA	336	250	NA

Milwaukee CMSA Inventory A
Emission Inventory Summary - VOC, NOx, CO
Percent of Total Inventory

	% total tpy			% total tpsd		% total tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	NA	0.10%	NA	2.31%	0.18%	NA
Airport Service	NA	1.43%	NA	0.15%	1.30%	NA
Recreational	NA	0.02%	NA	0.18%	0.01%	NA
Recreational Marine	NA	0.22%	NA	4.87%	0.57%	NA
Light Commercial	NA	0.19%	NA	0.61%	0.17%	NA
Industrial	NA	2.32%	NA	0.52%	2.11%	NA
Construction	NA	5.04%	NA	0.83%	7.88%	NA
Agricultural	NA	1.87%	NA	0.56%	3.40%	NA
Logging	NA	0.00%	NA	0.02%	0.00%	NA
Marine Vessels	NA	0.48%	NA	0.37%	0.44%	NA
Nonroad Engines and Vehicles	NA	11.67%	NA	10.41%	16.05%	NA
Highway Vehicles	NA	40.46%	NA	31.49%	40.45%	NA
Other Area and Point Sources	NA	47.87%	NA	58.10%	43.50%	NA
All Sources	NA	100.00%	NA	100.00%	100.00%	NA

Milwaukee CMSA Inventory A
Emission Inventory Summary - Air Toxics and SOx

Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
	tpy					
Lawn & Garden	26	15	39	16	341	14
Airport Service	132	6	5	3	4	78
Recreational	28	3	22	9	28	1
Recreational Marine	133	11	59	26	267	19
Light Commercial	27	9	20	8	107	19
Industrial	153	32	17	8	59	96
Construction	497	77	17	9	19	363
Agricultural	283	47	10	5	9	121
Logging	1	0	1	0	3	0
Marine Vessels	ND	ND	ND	ND	ND	ND
Nonroad Engines and Vehicles	1,281	200	191	84	835	710
Highway Vehicles	ND	ND	ND	ND	ND	ND
Other Area and Point Sources	ND	ND	ND	ND	ND	ND
All Sources	NA	NA	NA	NA	NA	NA

Milwaukee CMSA Inventory A
Emission Inventory Summary - Air Toxics and SOx
Percent of Total Inventory

Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
	% total tpy					
Lawn & Garden	NA	NA	NA	NA	NA	NA
Airport Service	NA	NA	NA	NA	NA	NA
Recreational	NA	NA	NA	NA	NA	NA
Recreational Marine	NA	NA	NA	NA	NA	NA
Light Commercial	NA	NA	NA	NA	NA	NA
Industrial	NA	NA	NA	NA	NA	NA
Construction	NA	NA	NA	NA	NA	NA
Agricultural	NA	NA	NA	NA	NA	NA
Logging	NA	NA	NA	NA	NA	NA
Marine Vessels	NA	NA	NA	NA	NA	NA
Nonroad Engines and Vehicles	NA	NA	NA	NA	NA	NA
Highway Vehicles	NA	NA	NA	NA	NA	NA
Other Area and Point Sources	NA	NA	NA	NA	NA	NA
All Sources	NA	NA	NA	NA	NA	NA

Minneapolis MSA Inventory A
Emission Inventory Summary - VOC, NOx, CO

Equipment Category	tpy VOC	tpy NOx	tpy CO	tpsd VOC	tpsd NOx	tpwd CO
Lawn & Garden	2,416	126	18,235	12	1	8
Airport Service	274	1,825	2,219	1	5	6
Recreational	1,096	19	1,993	1	0	16
Recreational Marine	13,410	460	29,019	101	4	0
Light Commercial	1,345	288	16,208	4	1	44
Industrial	965	2,994	13,648	3	8	37
Construction	1,286	9,018	7,209	6	42	8
Agricultural	979	4,399	4,379	5	24	3
Logging	44	0	132	0	0	0
Marine Vessels	ND	ND	28	ND	ND	0
Nonroad Engines and Vehicles	21,815	19,129	93,069	132	85	123
Highway Vehicles	ND	ND	419,140	ND	ND	2.422
Other Area and Point Sources	ND	63,307	125,911	ND	173	357
All Sources	NA	NA	638,120	NA	NA	2.901

Minneapolis MSA Inventory A
Emission Inventory Summary - VOC, NOx, CO
Percent of Total Inventory

Equipment Category	% total tpy VOC	% total tpy NOx	% total tpy CO	% total tpsd VOC	% total tpsd NOx	% total tpwd CO
Lawn & Garden	NA	NA	2.86%	NA	NA	0.26%
Airport Service	NA	NA	0.35%	NA	NA	0.21%
Recreational	NA	NA	0.31%	NA	NA	0.55%
Recreational Marine	NA	NA	4.55%	NA	NA	0.00%
Light Commercial	NA	NA	2.54%	NA	NA	1.53%
Industrial	NA	NA	2.14%	NA	NA	1.29%
Construction	NA	NA	1.13%	NA	NA	0.27%
Agricultural	NA	NA	0.69%	NA	NA	0.10%
Logging	NA	NA	0.02%	NA	NA	0.01%
Marine Vessels	NA	NA	0.00%	NA	NA	0.00%
Nonroad Engines and Vehicles	NA	NA	14.58%	NA	NA	4.23%
Highway Vehicles	NA	NA	65.68%	NA	NA	83.48%
Other Area and Point Sources	NA	NA	19.73%	NA	NA	12.30%
All Sources	NA	NA	100.00%	NA	NA	100.00%

Minneapolis MSA Inventory A
Emission Inventory Summary - Air Toxics and SOx

Equipment Category	PM	Aldehydes	Benzene	tpy 1,3 But.	Gas. Vap.	SOx
Lawn & Garden	41	22	61	25	525	22
Airport Service	205	9	8	4	6	121
Recreational	42	4	32	14	41	2
Recreational Marine	806	68	377	162	933	68
Light Commercial	49	17	37	15	195	34
Industrial	239	51	27	12	92	149
Construction	1,074	166	38	19	41	784
Agricultural	806	133	29	15	25	343
Logging	1	0	1	1	5	0
Marine Vessels	8	ND	ND	ND	ND	ND
Nonroad Engines and Vehicles	3,270	471	610	267	1,863	1,524
Highway Vehicles	42,282	ND	ND	ND	ND	ND
Other Area and Point Sources	214,398	ND	ND	ND	ND	ND
All Sources	259,950	NA	NA	NA	NA	NA

Minneapolis MSA Inventory A
Emission Inventory Summary - Air Toxics and SOx
Percent of Total Inventory

Equipment Category	PM	Aldehydes	Benzene	% total tpy 1,3 But.	Gas. Vap.	SOx
Lawn & Garden	0.02%	NA	NA	NA	NA	NA
Airport Service	0.08%	NA	NA	NA	NA	NA
Recreational	0.02%	NA	NA	NA	NA	NA
Recreational Marine	0.31%	NA	NA	NA	NA	NA
Light Commercial	0.02%	NA	NA	NA	NA	NA
Industrial	0.09%	NA	NA	NA	NA	NA
Construction	0.41%	NA	NA	NA	NA	NA
Agricultural	0.31%	NA	NA	NA	NA	NA
Logging	0.00%	NA	NA	NA	NA	NA
Marine Vessels	0.00%	NA	NA	NA	NA	NA
Nonroad Engines and Vehicles	1.26%	NA	NA	NA	NA	NA
Highway Vehicles	16.27%	NA	NA	NA	NA	NA
Other Area and Point Sources	82.48%	NA	NA	NA	NA	NA
All Sources	100.00%	NA	NA	NA	NA	NA

New York NECMA Inventory A
Emission Inventory Summary - VOC, NOx, CO

	tpy			tpsd		tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	16,017	909	129,415	80	5	55
Airport Service	573	3,818	4,634	2	10	13
Recreational	5,521	95	10,046	4	0	82
Recreational Marine	13,420	1,182	38,833	92	9	4
Light Commercial	11,519	2,464	138,936	32	7	381
Industrial	5,632	17,507	79,724	16	48	218
Construction	8,056	56,517	45,182	38	266	50
Agricultural	611	2,747	2,732	3	15	2
Logging	184	1	553	1	0	2
Marine Vessels	789	12,991	2,458	2	36	7
Nonroad Engines and Vehicles	62,322	98,230	452,512	270	396	813
Highway Vehicles	ND	317,257	3,129,400	1,114	956	7,373
Other Area and Point Sources	ND	232,882	546,500	1,578	638	804
All Sources	NA	648,369	4,128,412	2,962	1,990	8,990

New York NECMA Inventory A
Emission Inventory Summary - VOC, NOx, CO
Percent of Total Inventory

	% total tpy			% total tpsd		% total tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	NA	0.14%	3.13%	2.70%	0.25%	0.62%
Airport Service	NA	0.59%	0.11%	0.05%	0.53%	0.14%
Recreational	NA	0.01%	0.24%	0.14%	0.01%	0.91%
Recreational Marine	NA	0.18%	0.94%	3.11%	0.44%	0.05%
Light Commercial	NA	0.38%	3.37%	1.08%	0.34%	4.23%
Industrial	NA	2.70%	1.93%	0.54%	2.41%	2.43%
Construction	NA	8.72%	1.09%	1.28%	13.38%	0.55%
Agricultural	NA	0.42%	0.07%	0.11%	0.76%	0.02%
Logging	NA	0.00%	0.01%	0.02%	0.00%	0.02%
Marine Vessels	NA	2.00%	0.06%	0.07%	1.79%	0.07%
Nonroad Engines and Vehicles	NA	15.15%	10.96%	9.10%	19.90%	9.04%
Highway Vehicles	NA	48.93%	75.80%	37.62%	48.04%	82.02%
Other Area and Point Sources	NA	35.92%	13.24%	53.28%	32.06%	8.94%
All Sources	NA	100.00%	100.00%	100.00%	100.00%	100.00%

New York NECMA Inventory A
Emission Inventory Summary - Air Toxics and SOx

Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
	tpy					
Lawn & Garden	280	156	401	162	3,547	156
Airport Service	428	19	17	9	12	252
Recreational	210	22	161	69	201	8
Recreational Marine	644	95	322	138	2,803	107
Light Commercial	417	142	320	129	1,664	295
Industrial	1,399	296	158	70	528	874
Construction	6,726	1,041	237	122	254	4,912
Agricultural	503	83	18	9	15	214
Logging	4	2	5	2	20	0
Marine Vessels	620	ND	ND	ND	ND	4,240
Nonroad Engines and Vehicles	11,231	1,856	1,639	711	9,044	11,059
Highway Vehicles	232,769	ND	ND	ND	ND	ND
Other Area and Point Sources	119,873	ND	ND	ND	ND	ND
All Sources	363,873	NA	NA	NA	NA	NA

New York NECMA Inventory A
Emission Inventory Summary - Air Toxics and SOx
Percent of Total Inventory

Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
	% total tpy					
Lawn & Garden	0.08%	NA	NA	NA	NA	NA
Airport Service	0.12%	NA	NA	NA	NA	NA
Recreational	0.06%	NA	NA	NA	NA	NA
Recreational Marine	0.18%	NA	NA	NA	NA	NA
Light Commercial	0.11%	NA	NA	NA	NA	NA
Industrial	0.38%	NA	NA	NA	NA	NA
Construction	1.85%	NA	NA	NA	NA	NA
Agricultural	0.14%	NA	NA	NA	NA	NA
Logging	0.00%	NA	NA	NA	NA	NA
Marine Vessels	0.17%	NA	NA	NA	NA	NA
Nonroad Engines and Vehicles	3.09%	NA	NA	NA	NA	NA
Highway Vehicles	63.97%	NA	NA	NA	NA	NA
Other Area and Point Sources	32.94%	NA	NA	NA	NA	NA
All Sources	100.00%	NA	NA	NA	NA	NA

Philedelphia MSA Inventory A
Emission Inventory Summary - VOC, NOx, CO

	tpy			tpsd		tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	10,062	561	83,913	41	2	50
Airport Service	291	1,936	2,352	1	5	6
Recreational	1,399	26	2,822	2	0	19
Recreational Marine	9,207	967	29,429	55	6	6
Light Commercial	2,874	664	36,004	8	2	99
Industrial	1,804	5,553	25,392	5	15	70
Construction	2,934	20,499	16,585	12	85	27
Agricultural	842	3,822	3,806	4	17	3
Logging	120	1	363	0	0	1
Marine Vessels	494	9,181	1,377	1	25	4
Nonroad Engines and Vehicles	30,029	43,210	202,043	129	158	284
Highway Vehicles	ND	123,720	568,888	432	373	ND
Other Area and Point Sources	ND	137,579	178,772	911	377	ND
All Sources	NA	304,509	949,703	1,472	908	NA

Philedelphia MSA Inventory A
Emission Inventory Summary - VOC, NOx, CO
Percent of Total Inventory

	% total tpy			% total tpsd		% total tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	NA	0.18%	8.84%	2.77%	0.27%	NA
Airport Service	NA	0.64%	0.25%	0.05%	0.58%	NA
Recreational	NA	0.01%	0.30%	0.11%	0.00%	NA
Recreational Marine	NA	0.32%	3.10%	3.75%	0.67%	NA
Light Commercial	NA	0.22%	3.79%	0.54%	0.20%	NA
Industrial	NA	1.82%	2.67%	0.34%	1.68%	NA
Construction	NA	6.73%	1.75%	0.83%	9.40%	NA
Agricultural	NA	1.26%	0.40%	0.25%	1.85%	NA
Logging	NA	0.00%	0.04%	0.02%	0.00%	NA
Marine Vessels	NA	3.02%	0.14%	0.09%	2.77%	NA
Nonroad Engines and Vehicles	NA	14.19%	21.27%	8.77%	17.42%	NA
Highway Vehicles	NA	40.63%	59.90%	29.32%	41.07%	NA
Other Area and Point Sources	NA	45.18%	18.82%	61.91%	41.52%	NA
All Sources	NA	100.00%	100.00%	100.00%	100.00%	NA

Philedelphia MSA Inventory A
Emission Inventory Summary - Air Toxics and SOx

				tpy		
Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
Lawn & Garden	182	102	264	106	1,890	98
Airport Service	217	10	9	4	6	128
Recreational	49	6	41	17	67	2
Recreational Marine	473	72	237	101	1,412	85
Light Commercial	106	36	79	32	441	79
Industrial	445	94	51	23	165	278
Construction	2,422	376	86	44	91	1,783
Agricultural	701	115	25	13	18	298
Logging	3	1	3	1	13	0
Marine Vessels	553	ND	ND	ND	ND	4,366
Nonroad Engines and Vehicles	5,149	813	794	343	4,104	7,118
Highway Vehicles	ND	ND	ND	ND	ND	ND
Other Area and Point Sources	ND	ND	ND	ND	ND	ND
All Sources	NA	NA	NA	NA	NA	NA

Philedelphia MSA Inventory A
Emission Inventory Summary - Air Toxics and SOx
Percent of Total Inventory

				% total tpy		
Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
Lawn & Garden	NA	NA	NA	NA	NA	NA
Airport Service	NA	NA	NA	NA	NA	NA
Recreational	NA	NA	NA	NA	NA	NA
Recreational Marine	NA	NA	NA	NA	NA	NA
Light Commercial	NA	NA	NA	NA	NA	NA
Industrial	NA	NA	NA	NA	NA	NA
Construction	NA	NA	NA	NA	NA	NA
Agricultural	NA	NA	NA	NA	NA	NA
Logging	NA	NA	NA	NA	NA	NA
Marine Vessels	NA	NA	NA	NA	NA	NA
Nonroad Engines and Vehicles	NA	NA	NA	NA	NA	NA
Highway Vehicles	NA	NA	NA	NA	NA	NA
Other Area and Point Sources	NA	NA	NA	NA	NA	NA
All Sources	NA	NA	NA	NA	NA	NA

Provo-Orem MSA Inventory A
Emission Inventory Summary - VOC, NOx, CO

	tpy			tpsd		tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	558	32	4,732	3	0	1
Airport Service	0	0	0	0	0	0
Recreational	395	7	751	0	0	6
Recreational Marine	58	8	166	0	0	0
Light Commercial	75	17	939	0	0	3
Industrial	50	152	696	0	0	2
Construction	87	612	495	0	3	1
Agricultural	101	461	451	1	3	0
Logging	5	0	16	0	0	0
Marine Vessels	ND	ND	315	ND	ND	1
Nonroad Engines and Vehicles	1,329	1,290	8,561	5	6	13
Highway Vehicles	ND	ND	73,804	ND	ND	440
Other Area and Point Sources	ND	ND	38,273	ND	ND	38
All Sources	NA	NA	120,638	NA	NA	492

Provo-Orem MSA Inventory A
Emission Inventory Summary - VOC, NOx, CO
Percent of Total Inventory

	% total tpy			% total tpsd		% total tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	NA	NA	3.92%	NA	NA	0.28%
Airport Service	NA	NA	0.00%	NA	NA	0.00%
Recreational	NA	NA	0.62%	NA	NA	1.12%
Recreational Marine	NA	NA	0.14%	NA	NA	0.00%
Light Commercial	NA	NA	0.78%	NA	NA	0.52%
Industrial	NA	NA	0.58%	NA	NA	0.39%
Construction	NA	NA	0.41%	NA	NA	0.11%
Agricultural	NA	NA	0.37%	NA	NA	0.06%
Logging	NA	NA	0.01%	NA	NA	0.01%
Marine Vessels	NA	NA	0.26%	NA	NA	0.18%
Nonroad Engines and Vehicles	NA	NA	7.10%	NA	NA	2.67%
Highway Vehicles	NA	NA	61.18%	NA	NA	89.53%
Other Area and Point Sources	NA	NA	31.73%	NA	NA	7.80%
All Sources	NA	NA	100.00%	NA	NA	100.00%

Provo-Orem MSA Inventory A
Emission Inventory Summary - Air Toxics and SOx

Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
	tpy					
Lawn & Garden	10	6	14	6	115	6
Airport Service	0	0	0	0	0	0
Recreational	14	2	11	5	16	1
Recreational Marine	2	0	1	0	20	1
Light Commercial	3	1	2	1	12	2
Industrial	12	3	1	1	5	8
Construction	72	11	3	1	3	53
Agricultural	85	14	3	2	2	36
Logging	0	0	0	0	1	0
Marine Vessels	ND	ND	ND	ND	ND	ND
Nonroad Engines and Vehicles	199	36	36	16	172	106
Highway Vehicles	3,668	ND	ND	ND	ND	ND
Other Area and Point Sources	45,615	ND	ND	ND	ND	ND
All Sources	49,482	NA	NA	NA	NA	NA

Provo-Orem MSA Inventory A
Emission Inventory Summary - Air Toxics and SOx
Percent of Total Inventory

Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
	% total tpy					
Lawn & Garden	0.02%	NA	NA	NA	NA	NA
Airport Service	0.00%	NA	NA	NA	NA	NA
Recreational	0.03%	NA	NA	NA	NA	NA
Recreational Marine	0.00%	NA	NA	NA	NA	NA
Light Commercial	0.01%	NA	NA	NA	NA	NA
Industrial	0.02%	NA	NA	NA	NA	NA
Construction	0.15%	NA	NA	NA	NA	NA
Agricultural	0.17%	NA	NA	NA	NA	NA
Logging	0.00%	NA	NA	NA	NA	NA
Marine Vessels	0.00%	NA	NA	NA	NA	NA
Nonroad Engines and Vehicles	0.40%	NA	NA	NA	NA	NA
Highway Vehicles	7.41%	NA	NA	NA	NA	NA
Other Area and Point Sources	92.19%	NA	NA	NA	NA	NA
All Sources	100.00%	NA	NA	NA	NA	NA

Saint Louis MSA Inventory A
Emission Inventory Summary - VOC, NOx, CO

Equipment Category	tpy VOC	tpy NOx	tpy CO	tpsd VOC	tpsd NOx	tpwd CO
Lawn & Garden	2,759	143	20,723	14	1	9
Airport Service	199	1,321	1,607	1	4	4
Recreational	979	17	1,780	1	0	14
Recreational Marine	4,582	271	11,564	33	2	0
Light Commercial	1,189	254	14,326	3	1	39
Industrial	929	2,882	13,138	3	8	36
Construction	1,384	9,708	7,761	7	46	9
Agricultural	810	3,637	3,620	4	20	2
Logging	52	0	156	0	0	0
Marine Vessels	2,488	1,820	ND	7	5	ND
Nonroad Engines and Vehicles	15,370	20,054	74,675	72	86	114
Highway Vehicles	ND	62,039	ND	208	187	1,710
Other Area and Point Sources	ND	158,510	ND	360	434	441
All Sources	NA	240,603	NA	640	707	2,265

Saint Louis MSA Inventory A
Emission Inventory Summary - VOC, NOx, CO
Percent of Total Inventory

Equipment Category	% total tpy VOC	% total tpy NOx	% total tpy CO	% total tpsd VOC	% total tpsd NOx	% total tpwd CO
Lawn & Garden	NA	0.06%	NA	2.17%	0.11%	0.38%
Airport Service	NA	0.55%	NA	0.09%	0.51%	0.19%
Recreational	NA	0.01%	NA	0.12%	0.00%	0.63%
Recreational Marine	NA	0.11%	NA	5.22%	0.29%	0.00%
Light Commercial	NA	0.11%	NA	0.52%	0.10%	1.73%
Industrial	NA	1.20%	NA	0.41%	1.12%	1.59%
Construction	NA	4.04%	NA	1.02%	6.47%	0.38%
Agricultural	NA	1.51%	NA	0.69%	2.82%	0.11%
Logging	NA	0.00%	NA	0.02%	0.00%	0.02%
Marine Vessels	NA	0.76%	NA	1.06%	0.71%	0.00%
Nonroad Engines and Vehicles	NA	8.33%	NA	11.31%	12.13%	5.03%
Highway Vehicles	NA	25.78%	NA	32.45%	26.45%	75.49%
Other Area and Point Sources	NA	65.88%	NA	56.24%	61.43%	19.48%
All Sources	NA	100.00%	NA	100.00%	100.00%	100.00%

Saint Louis MSA Inventory A
Emission Inventory Summary - Air Toxics and SOx

Equipment Category	PM	Aldehydes	Benzene	tpy 1,3 But.	Gas. Vap.	SOx
Lawn & Garden	47	26	70	28	598	25
Airport Service	148	7	6	3	4	87
Recreational	37	4	29	12	36	1
Recreational Marine	249	28	120	52	619	29
Light Commercial	43	15	33	13	173	30
Industrial	230	49	26	12	89	144
Construction	1,156	179	41	21	44	844
Agricultural	666	110	24	12	21	284
Logging	1	0	1	1	6	0
Marine Vessels	184	ND	ND	ND	ND	ND
Nonroad Engines and Vehicles	2,761	416	349	154	1,589	1,445
Highway Vehicles	38,099	ND	ND	ND	ND	ND
Other Area and Point Sources	89,636	ND	ND	ND	ND	ND
All Sources	130,496	NA	NA	NA	NA	NA

Saint Louis MSA Inventory A
Emission Inventory Summary - Air Toxics and SOx
Percent of Total Inventory

Equipment Category	PM	Aldehydes	Benzene	% total tpy 1,3 But.	Gas. Vap.	SOx
Lawn & Garden	0.04%	NA	NA	NA	NA	NA
Airport Service	0.11%	NA	NA	NA	NA	NA
Recreational	0.03%	NA	NA	NA	NA	NA
Recreational Marine	0.19%	NA	NA	NA	NA	NA
Light Commercial	0.03%	NA	NA	NA	NA	NA
Industrial	0.18%	NA	NA	NA	NA	NA
Construction	0.89%	NA	NA	NA	NA	NA
Agricultural	0.51%	NA	NA	NA	NA	NA
Logging	0.00%	NA	NA	NA	NA	NA
Marine Vessels	0.14%	NA	NA	NA	NA	NA
Nonroad Engines and Vehicles	2.12%	NA	NA	NA	NA	NA
Highway Vehicles	29.20%	NA	NA	NA	NA	NA
Other Area and Point Sources	68.69%	NA	NA	NA	NA	NA
All Sources	100.00%	NA	NA	NA	NA	NA

San Diego AB Inventory A
Emission Inventory Summary - VOC, NOx, CO

	tpy			tpsd		tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	6,829	387	58,927	25	1	41
Airport Service	216	1,439	1,750	1	4	5
Recreational	1,197	33	4,181	5	0	6
Recreational Marine	3,662	593	14,993	19	3	11
Light Commercial	936	241	12,318	3	1	34
Industrial	557	1,704	7,808	2	5	21
Construction	2,078	14,383	11,868	8	52	26
Agricultural	265	1,215	1,197	1	5	1
Logging	60	0	180	0	0	0
Marine Vessels	ND	ND	ND	3	41	7
Nonroad Engines and Vehicles	15,800	19,996	113,223	65	112	153
Highway Vehicles	ND	47,136	570,100	130	142	1,343
Other Area and Point Sources	ND	ND	94,000	271	34	154
All Sources	NA	NA	777,323	465	288	1,650

San Diego AB Inventory A
Emission Inventory Summary - VOC, NOx, CO
Percent of Total Inventory

	% total tpy			% total tpsd		% total tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	NA	NA	7.58%	5.40%	0.50%	2.51%
Airport Service	NA	NA	0.23%	0.13%	1.37%	0.29%
Recreational	NA	NA	0.54%	1.05%	0.05%	0.36%
Recreational Marine	NA	NA	1.93%	4.02%	1.08%	0.70%
Light Commercial	NA	NA	1.58%	0.56%	0.23%	2.05%
Industrial	NA	NA	1.00%	0.34%	1.62%	1.30%
Construction	NA	NA	1.53%	1.62%	18.08%	1.58%
Agricultural	NA	NA	0.15%	0.21%	1.57%	0.05%
Logging	NA	NA	0.02%	0.04%	0.00%	0.03%
Marine Vessels	NA	NA	0.00%	0.54%	14.29%	0.41%
Nonroad Engines and Vehicles	NA	NA	14.57%	13.89%	38.79%	9.26%
Highway Vehicles	NA	NA	73.34%	27.87%	49.36%	81.43%
Other Area and Point Sources	NA	NA	12.09%	58.24%	11.85%	9.31%
All Sources	NA	NA	100.00%	100.00%	100.00%	100.00%

San Diego AB Inventory A
Emission Inventory Summary - Air Toxics and SOx

				tpy		
Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
Lawn & Garden	128	72	183	74	1,166	68
Airport Service	161	7	6	3	4	95
Recreational	12	7	33	14	134	3
Recreational Marine	167	38	89	38	725	46
Light Commercial	36	12	26	10	151	29
Industrial	137	29	16	7	49	86
Construction	1,698	265	61	31	64	1,252
Agricultural	223	37	8	4	5	95
Logging	1	1	2	1	6	0
Marine Vessels	854	ND	ND	ND	ND	6,979
Nonroad Engines and Vehicles	3,418	467	424	182	2,305	8,652
Highway Vehicles	6,935	ND	ND	ND	ND	2,409
Other Area and Point Sources	179,215	ND	ND	ND	ND	3,723
All Sources	189,568	NA	NA	NA	NA	14,784

San Diego AB Inventory A
Emission Inventory Summary - Air Toxics and SOx
Percent of Total Inventory

				% total tpy		
Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
Lawn & Garden	0.07%	NA	NA	NA	NA	0.46%
Airport Service	0.09%	NA	NA	NA	NA	0.64%
Recreational	0.01%	NA	NA	NA	NA	0.02%
Recreational Marine	0.09%	NA	NA	NA	NA	0.31%
Light Commercial	0.02%	NA	NA	NA	NA	0.19%
Industrial	0.07%	NA	NA	NA	NA	0.58%
Construction	0.90%	NA	NA	NA	NA	8.47%
Agricultural	0.12%	NA	NA	NA	NA	0.64%
Logging	0.00%	NA	NA	NA	NA	0.00%
Marine Vessels	0.45%	NA	NA	NA	NA	47.20%
Nonroad Engines and Vehicles	1.80%	NA	NA	NA	NA	58.52%
Highway Vehicles	3.66%	NA	NA	NA	NA	16.29%
Other Area and Point Sources	94.54%	NA	NA	NA	NA	25.18%
All Sources	100.00%	NA	NA	NA	NA	100.00%

San Joaquin AB Inventory A

Emission Inventory Summary - VOC, NOx, CO

	tpy			tpsd		tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	4,728	221	35,057	17	1	28
Airport Service	25	163	202	0	0	1
Recreational	244	7	852	1	0	1
Recreational Marine	917	254	4,374	5	1	3
Light Commercial	985	254	12,969	3	1	36
Industrial	453	1,387	6,356	1	4	17
Construction	1,633	11,303	9,326	6	41	20
Agricultural	3,636	16,706	16,452	14	62	11
Logging	136	145	520	0	0	1
Marine Vessels	ND	ND	ND	0	3	0
Nonroad Engines and Vehicles	12,757	30,440	86,109	46	113	119
Highway Vehicles	ND	ND	ND	150	240	1,100
Other Area and Point Sources	ND	ND	ND	1,022	249	683
All Sources	NA	NA	NA	1,219	602	1,903

San Joaquin AB Inventory A

Emission Inventory Summary - VOC, NOx, CO

Percent of Total Inventory

	% total tpy			% total tpsd		% total tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	NA	NA	NA	1.36%	0.14%	1.49%
Airport Service	NA	NA	NA	0.01%	0.07%	0.03%
Recreational	NA	NA	NA	0.09%	0.01%	0.06%
Recreational Marine	NA	NA	NA	0.37%	0.22%	0.18%
Light Commercial	NA	NA	NA	0.22%	0.12%	1.87%
Industrial	NA	NA	NA	0.10%	0.63%	0.92%
Construction	NA	NA	NA	0.49%	6.79%	1.07%
Agricultural	NA	NA	NA	1.11%	10.34%	0.57%
Logging	NA	NA	NA	0.03%	0.07%	0.07%
Marine Vessels	NA	NA	NA	0.02%	0.44%	0.02%
Nonroad Engines and Vehicles	NA	NA	NA	3.81%	18.82%	6.28%
Highway Vehicles	NA	NA	NA	12.31%	39.87%	57.82%
Other Area and Point Sources	NA	NA	NA	83.88%	41.31%	35.91%
All Sources	NA	NA	NA	100.00%	100.00%	100.00%

San Joaquin AB Inventory A
Emission Inventory Summary - Air Toxics and SOx

			tpy			
Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
Lawn & Garden	82	45	128	52	761	40
Airport Service	18	1	1	0	0	11
Recreational	2	1	7	3	27	1
Recreational Marine	29	11	17	7	369	18
Light Commercial	38	13	27	11	159	30
Industrial	112	24	13	6	40	70
Construction	1,335	208	48	25	50	984
Agricultural	3,066	504	108	56	66	1,304
Logging	21	4	4	2	14	12
Marine Vessels	62	ND	ND	ND	ND	402
Nonroad Engines and Vehicles	4,765	810	352	161	1,488	2,870
Highway Vehicles	13,505	ND	ND	ND	ND	9,125
Other Area and Point Sources	731,789	ND	ND	ND	ND	16,790
All Sources	750,059	NA	NA	NA	NA	28,785

San Joaquin AB Inventory A
Emission Inventory Summary - Air Toxics and SOx
Percent of Total Inventory

			% total tpy			
Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
Lawn & Garden	0.01%	NA	NA	NA	NA	0.14%
Airport Service	0.00%	NA	NA	NA	NA	0.04%
Recreational	0.00%	NA	NA	NA	NA	0.00%
Recreational Marine	0.00%	NA	NA	NA	NA	0.06%
Light Commercial	0.01%	NA	NA	NA	NA	0.10%
Industrial	0.01%	NA	NA	NA	NA	0.24%
Construction	0.18%	NA	NA	NA	NA	3.42%
Agricultural	0.41%	NA	NA	NA	NA	4.53%
Logging	0.00%	NA	NA	NA	NA	0.04%
Marine Vessels	0.01%	NA	NA	NA	NA	1.39%
Nonroad Engines and Vehicles	0.64%	NA	NA	NA	NA	9.97%
Highway Vehicles	1.80%	NA	NA	NA	NA	31.70%
Other Area and Point Sources	97.56%	NA	NA	NA	NA	58.33%
All Sources	100.00%	NA	NA	NA	NA	100.00%

Seattle-Tacoma MSA Inventory A
Emission Inventory Summary - VOC, NOx, CO

	tpy			tpsd		tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	4,935	264	39,863	20	1	19
Airport Service	195	1,295	1,577	1	4	4
Recreational	833	21	2,525	3	0	7
Recreational Marine	5,478	723	17,250	31	5	9
Light Commercial	1,086	272	14,140	3	1	39
Industrial	628	1,915	8,781	2	5	24
Construction	1,854	12,958	10,571	8	54	17
Agricultural	268	1,232	1,191	1	5	1
Logging	263	1,511	1,966	1	4	5
Marine Vessels	2,194	17,253	31,940	6	47	88
Nonroad Engines and Vehicles	17,735	37,443	129,804	75	126	213
Highway Vehicles	ND	ND	267,670	ND	ND	1,515
Other Area and Point Sources	ND	ND	199,979	ND	ND	565
All Sources	NA	NA	597,453	NA	NA	2,293

Seattle-Tacoma MSA Inventory A
Emission Inventory Summary - VOC, NOx, CO
Percent of Total Inventory

	% total tpy			% total tpsd		% total tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	NA	NA	6.67%	NA	NA	0.82%
Airport Service	NA	NA	0.26%	NA	NA	0.19%
Recreational	NA	NA	0.42%	NA	NA	0.29%
Recreational Marine	NA	NA	2.89%	NA	NA	0.41%
Light Commercial	NA	NA	2.37%	NA	NA	1.69%
Industrial	NA	NA	1.47%	NA	NA	1.05%
Construction	NA	NA	1.77%	NA	NA	0.76%
Agricultural	NA	NA	0.20%	NA	NA	0.03%
Logging	NA	NA	0.33%	NA	NA	0.23%
Marine Vessels	NA	NA	5.35%	NA	NA	3.82%
Nonroad Engines and Vehicles	NA	NA	21.73%	NA	NA	9.29%
Highway Vehicles	NA	NA	44.80%	NA	NA	66.07%
Other Area and Point Sources	NA	NA	33.47%	NA	NA	24.64%
All Sources	NA	NA	100.00%	NA	NA	100.00%

Seattle-Tacoma MSA Inventory A
Emission Inventory Summary - Air Toxics and SOx

Equipment Category	PM	Aldehydes	Benzene	tpy 1,3 But.	Gas. Vap.	SOx
Lawn & Garden	84	48	130	53	891	46
Airport Service	145	7	6	3	4	86
Recreational	15	4	23	10	79	2
Recreational Marine	233	43	118	51	1,589	58
Light Commercial	41	14	30	12	178	32
Industrial	154	33	18	8	57	96
Construction	1,524	237	55	28	57	1,128
Agricultural	226	37	8	4	5	96
Logging	194	29	8	3	26	125
Marine Vessels	1,017	ND	ND	ND	ND	7,576
Nonroad Engines and Vehicles	3,633	452	395	171	2,887	9,245
Highway Vehicles	30,151	ND	ND	ND	ND	ND
Other Area and Point Sources	37,878	ND	ND	ND	ND	ND
All Sources	71,662	NA	NA	NA	NA	NA

Seattle-Tacoma MSA Inventory A
Emission Inventory Summary - Air Toxics and SOx
Percent of Total Inventory

Equipment Category	PM	Aldehydes	Benzene	% total tpy 1,3 But.	Gas. Vap.	SOx
Lawn & Garden	0.12%	NA	NA	NA	NA	NA
Airport Service	0.20%	NA	NA	NA	NA	NA
Recreational	0.02%	NA	NA	NA	NA	NA
Recreational Marine	0.33%	NA	NA	NA	NA	NA
Light Commercial	0.06%	NA	NA	NA	NA	NA
Industrial	0.21%	NA	NA	NA	NA	NA
Construction	2.13%	NA	NA	NA	NA	NA
Agricultural	0.32%	NA	NA	NA	NA	NA
Logging	0.27%	NA	NA	NA	NA	NA
Marine Vessels	1.42%	NA	NA	NA	NA	NA
Nonroad Engines and Vehicles	5.07%	NA	NA	NA	NA	NA
Highway Vehicles	42.07%	NA	NA	NA	NA	NA
Other Area and Point Sources	52.86%	NA	NA	NA	NA	NA
All Sources	100.00%	NA	NA	NA	NA	NA

South Coast AB Inventory A
Emission Inventory Summary - VOC, NOx, CO

	tpy			tpsd		tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	33,568	1,929	292,968	124	7	203
Airport Service	818	5,447	6,618	2	15	18
Recreational	4,322	119	15,099	18	0	22
Recreational Marine	16,126	2,668	66,521	82	14	51
Light Commercial	7,532	1,944	99,164	21	5	272
Industrial	5,530	16,917	77,518	16	46	212
Construction	9,911	68,596	56,599	36	248	124
Agricultural	601	2,761	2,719	2	10	2
Logging	256	75	826	1	0	2
Marine Vessels	ND	ND	ND	7	68	10
Nonroad Engines and Vehicles	78,662	100,455	618,032	309	415	917
Highway Vehicles	ND	ND	ND	650	660	9,732
Other Area and Point Sources	ND	ND	ND	1,400	334	265
All Sources	NA	NA	NA	2,359	1,409	10,914

South Coast AB Inventory A
Emission Inventory Summary - VOC, NOx, CO
Percent of Total Inventory

	% total tpy			% total tpsd		% total tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	NA	NA	NA	5.26%	0.51%	1.86%
Airport Service	NA	NA	NA	0.10%	1.06%	0.17%
Recreational	NA	NA	NA	0.75%	0.03%	0.20%
Recreational Marine	NA	NA	NA	3.49%	1.00%	0.47%
Light Commercial	NA	NA	NA	0.89%	0.38%	2.49%
Industrial	NA	NA	NA	0.66%	3.29%	1.95%
Construction	NA	NA	NA	1.52%	17.61%	1.14%
Agricultural	NA	NA	NA	0.10%	0.73%	0.02%
Logging	NA	NA	NA	0.03%	0.01%	0.02%
Marine Vessels	NA	NA	NA	0.31%	4.85%	0.10%
Nonroad Engines and Vehicles	NA	NA	NA	13.08%	29.47%	8.40%
Highway Vehicles	NA	NA	NA	27.56%	46.84%	89.17%
Other Area and Point Sources	NA	NA	NA	59.36%	23.69%	2.43%
All Sources	NA	NA	NA	100.00%	100.00%	100.00%

South Coast AB Inventory A
Emission Inventory Summary - Air Toxics and SOx

				tpy		
Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
Lawn & Garden	634	356	899	362	5,756	339
Airport Service	610	28	24	12	16	360
Recreational	44	25	121	50	484	10
Recreational Marine	730	167	392	168	3,262	206
Light Commercial	289	96	207	83	1,218	230
Industrial	1,362	288	156	70	486	849
Construction	8,099	1,265	292	150	306	5,972
Agricultural	507	83	18	9	11	215
Logging	15	4	7	3	27	7
Marine Vessels	1,515	ND	ND	ND	ND	12,797
Nonroad Engines and Vehicles	13,803	2,310	2,115	906	11,567	20,985
Highway Vehicles	34,675	ND	ND	ND	ND	11,680
Other Area and Point Sources	766,500	ND	ND	ND	ND	18,214
All Sources	814,978	NA	NA	NA	NA	50,879

South Coast AB Inventory A
Emission Inventory Summary - Air Toxics and SOx
Percent of Total Inventory

				% total tpy		
Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
Lawn & Garden	0.08%	NA	NA	NA	NA	0.67%
Airport Service	0.07%	NA	NA	NA	NA	0.71%
Recreational	0.01%	NA	NA	NA	NA	0.02%
Recreational Marine	0.09%	NA	NA	NA	NA	0.41%
Light Commercial	0.04%	NA	NA	NA	NA	0.45%
Industrial	0.17%	NA	NA	NA	NA	1.67%
Construction	0.99%	NA	NA	NA	NA	11.74%
Agricultural	0.06%	NA	NA	NA	NA	0.42%
Logging	0.00%	NA	NA	NA	NA	0.01%
Marine Vessels	0.19%	NA	NA	NA	NA	25.15%
Nonroad Engines and Vehicles	1.69%	NA	NA	NA	NA	41.25%
Highway Vehicles	4.25%	NA	NA	NA	NA	22.96%
Other Area and Point Sources	94.05%	NA	NA	NA	NA	35.80%
All Sources	100.00%	NA	NA	NA	NA	100.00%

Springfield MSA Inventory A
Emission Inventory Summary - VOC, NOx, CO

Equipment Category	tpy VOC	tpy NOx	tpy CO	tpsd VOC	tpsd NOx	tpwd CO
Lawn & Garden	640	33	4,838	3	0	2
Airport Service	0	0	0	0	0	0
Recreational	529	9	962	0	0	8
Recreational Marine	620	70	2,147	4	1	0
Light Commercial	278	60	3,358	1	0	9
Industrial	204	633	2,882	1	2	8
Construction	200	1,404	1,122	1	7	1
Agricultural	77	345	344	0	2	0
Logging	12	0	37	0	0	0
Marine Vessels	0	0	0	0	0	ND
Nonroad Engines and Vehicles	2,559	2,554	15,689	11	11	29
Highway Vehicles	ND	ND	ND	62	30	ND
Other Area and Point Sources	ND	ND	ND	50	30	ND
All Sources	NA	NA	NA	123	71	NA

Springfield MSA Inventory A
Emission Inventory Summary - VOC, NOx, CO
Percent of Total Inventory

Equipment Category	% total tpy VOC	% total tpy NOx	% total tpy CO	% total tpsd VOC	% total tpsd NOx	% total tpwd CO
Lawn & Garden	NA	NA	NA	2.63%	0.25%	NA
Airport Service	NA	NA	NA	0.00%	0.00%	NA
Recreational	NA	NA	NA	0.34%	0.02%	NA
Recreational Marine	NA	NA	NA	3.41%	0.74%	NA
Light Commercial	NA	NA	NA	0.63%	0.23%	NA
Industrial	NA	NA	NA	0.47%	2.43%	NA
Construction	NA	NA	NA	0.77%	9.26%	NA
Agricultural	NA	NA	NA	0.34%	2.65%	NA
Logging	NA	NA	NA	0.03%	0.00%	NA
Marine Vessels	NA	NA	NA	0.00%	0.00%	NA
Nonroad Engines and Vehicles	NA	NA	NA	8.60%	15.57%	NA
Highway Vehicles	NA	NA	NA	50.92%	42.43%	NA
Other Area and Point Sources	NA	NA	NA	40.48%	42.00%	NA
All Sources	NA	NA	NA	100.00%	100.00%	NA

Springfield MSA Inventory A
Emission Inventory Summary - Air Toxics and SOx

	tpy					
Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
Lawn & Garden	11	6	16	7	136	6
Airport Service	0	0	0	0	0	0
Recreational	20	2	15	7	19	1
Recreational Marine	27	5	14	6	155	6
Light Commercial	10	3	8	3	40	7
Industrial	51	11	6	3	19	32
Construction	167	26	6	3	6	122
Agricultural	63	10	2	1	2	27
Logging	0	0	0	0	1	0
Marine Vessels	0	0	ND	ND	ND	0
Nonroad Engines and Vehicles	349	64	68	29	380	200
Highway Vehicles	ND	ND	ND	ND	ND	ND
Other Area and Point Sources	ND	ND	ND	ND	ND	ND
All Sources	NA	NA	NA	NA	NA	NA

Springfield MSA Inventory A
Emission Inventory Summary - Air Toxics and SOx
Percent of Total Inventory

	% total tpy					
Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
Lawn & Garden	NA	NA	NA	NA	NA	NA
Airport Service	NA	NA	NA	NA	NA	NA
Recreational	NA	NA	NA	NA	NA	NA
Recreational Marine	NA	NA	NA	NA	NA	NA
Light Commercial	NA	NA	NA	NA	NA	NA
Industrial	NA	NA	NA	NA	NA	NA
Construction	NA	NA	NA	NA	NA	NA
Agricultural	NA	NA	NA	NA	NA	NA
Logging	NA	NA	NA	NA	NA	NA
Marine Vessels	NA	NA	NA	NA	NA	NA
Nonroad Engines and Vehicles	NA	NA	NA	NA	NA	NA
Highway Vehicles	NA	NA	NA	NA	NA	NA
Other Area and Point Sources	NA	NA	NA	NA	NA	NA
All Sources	NA	NA	NA	NA	NA	NA

Spokane MSA Inventory A
Emission Inventory Summary - VOC, NOx, CO

Equipment Category	tpy VOC	tpy NOx	tpy CO	tpsd VOC	tpsd NOx	tpwd CO
Lawn & Garden	514	26	3,926	3	0	0
Airport Service	27	178	221	0	0	1
Recreational	148	4	432	0	0	1
Recreational Marine	387	15	795	3	0	0
Light Commercial	169	39	2,107	0	0	6
Industrial	57	175	799	0	0	2
Construction	150	1,049	848	1	5	1
Agricultural	140	637	623	1	3	0
Logging	12	0	38	0	0	0
Marine Vessels	ND	ND	245	ND	ND	1
Nonroad Engines and Vehicles	1,604	2,123	10,034	8	10	12
Highway Vehicles	ND	ND	9,026	ND	ND	251
Other Area and Point Sources	ND	ND	77,748	ND	ND	224
All Sources	NA	NA	96,808	NA	NA	487

Spokane MSA Inventory A
Emission Inventory Summary - VOC, NOx, CO
Percent of Total Inventory

Equipment Category	% total tpy VOC	% total tpy NOx	% total tpy CO	% total tpsd VOC	% total tpsd NOx	% total tpwd CO
Lawn & Garden	NA	NA	4.06%	NA	NA	0.02%
Airport Service	NA	NA	0.23%	NA	NA	0.12%
Recreational	NA	NA	0.45%	NA	NA	0.21%
Recreational Marine	NA	NA	0.82%	NA	NA	0.00%
Light Commercial	NA	NA	2.18%	NA	NA	1.19%
Industrial	NA	NA	0.82%	NA	NA	0.45%
Construction	NA	NA	0.88%	NA	NA	0.19%
Agricultural	NA	NA	0.64%	NA	NA	0.08%
Logging	NA	NA	0.04%	NA	NA	0.02%
Marine Vessels	NA	NA	0.25%	NA	NA	0.14%
Nonroad Engines and Vehicles	NA	NA	10.36%	NA	NA	2.43%
Highway Vehicles	NA	NA	9.32%	NA	NA	51.60%
Other Area and Point Sources	NA	NA	80.31%	NA	NA	45.97%
All Sources	NA	NA	100.00%	NA	NA	100.00%

Spokane MSA Inventory A
Emission Inventory Summary - Air Toxics and SOx

Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
	tpy					
Lawn & Garden	8	5	13	5	98	5
Airport Service	20	1	1	0	1	12
Recreational	3	1	4	2	14	0
Recreational Marine	23	2	11	5	30	2
Light Commercial	6	2	5	2	26	5
Industrial	14	3	2	1	5	9
Construction	124	19	4	2	5	91
Agricultural	117	19	4	2	3	50
Logging	0	0	0	0	1	0
Marine Vessels	ND	ND	ND	ND	ND	ND
Nonroad Engines and Vehicles	316	52	44	19	184	173
Highway Vehicles	3,881	ND	ND	ND	ND	ND
Other Area and Point Sources	9,837	ND	ND	ND	ND	ND
All Sources	14,034	NA	NA	NA	NA	NA

Spokane MSA Inventory A
Emission Inventory Summary - Air Toxics and SOx
Percent of Total Inventory

Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
	% total tpy					
Lawn & Garden	0.06%	NA	NA	NA	NA	NA
Airport Service	0.14%	NA	NA	NA	NA	NA
Recreational	0.02%	NA	NA	NA	NA	NA
Recreational Marine	0.17%	NA	NA	NA	NA	NA
Light Commercial	0.04%	NA	NA	NA	NA	NA
Industrial	0.10%	NA	NA	NA	NA	NA
Construction	0.88%	NA	NA	NA	NA	NA
Agricultural	0.83%	NA	NA	NA	NA	NA
Logging	0.00%	NA	NA	NA	NA	NA
Marine Vessels	0.00%	NA	NA	NA	NA	NA
Nonroad Engines and Vehicles	2.25%	NA	NA	NA	NA	NA
Highway Vehicles	27.65%	NA	NA	NA	NA	NA
Other Area and Point Sources	70.09%	NA	NA	NA	NA	NA
All Sources	100.00%	NA	NA	NA	NA	NA

Washington DC MSA Inventory A
Emission Inventory Summary - VOC, NOx, CO

Equipment Category	tpy VOC	tpy NOx	tpy CO	tpsd VOC	tpsd NOx	tpwd CO
Lawn & Garden	6,612	352	53,073	27	2	26
Airport Service	389	2,589	3,148	1	7	9
Recreational	870	19	2,312	2	0	8
Recreational Marine	1,838	181	6,013	11	1	1
Light Commercial	1,204	278	15,084	3	1	41
Industrial	376	1,158	5,296	1	3	15
Construction	2,560	17,885	14,470	11	74	24
Agricultural	523	2,372	2,362	2	10	2
Logging	121	1	364	0	0	1
Marine Vessels	806	227	2,820	2	1	8
Nonroad Engines and Vehicles	15,300	25,062	104,941	61	99	134
Highway Vehicles	ND	83,068	398,686	345	250	2,161
Other Area and Point Sources	ND	88,336	59,024	202	242	167
All Sources	NA	196,466	562,651	608	592	2,462

Washington DC MSA Inventory A
Emission Inventory Summary - VOC, NOx, CO
Percent of Total Inventory

Equipment Category	% total tpy VOC	% total tpy NOx	% total tpy CO	% total tpsd VOC	% total tpsd NOx	% total tpwd CO
Lawn & Garden	NA	0.18%	9.43%	4.40%	0.26%	1.06%
Airport Service	NA	1.32%	0.56%	0.18%	1.20%	0.35%
Recreational	NA	0.01%	0.41%	0.37%	0.01%	0.34%
Recreational Marine	NA	0.09%	1.07%	1.83%	0.19%	0.05%
Light Commercial	NA	0.14%	2.68%	0.55%	0.13%	1.68%
Industrial	NA	0.59%	0.94%	0.17%	0.54%	0.59%
Construction	NA	9.10%	2.57%	1.75%	12.59%	0.97%
Agricultural	NA	1.21%	0.42%	0.38%	1.76%	0.06%
Logging	NA	0.00%	0.06%	0.05%	0.00%	0.04%
Marine Vessels	NA	0.12%	0.50%	0.36%	0.11%	0.31%
Nonroad Engines and Vehicles	NA	12.76%	18.65%	10.05%	16.78%	5.46%
Highway Vehicles	NA	42.28%	70.86%	56.73%	42.31%	87.77%
Other Area and Point Sources	NA	44.96%	10.49%	33.22%	40.91%	6.77%
All Sources	NA	100.00%	100.00%	100.00%	100.00%	100.00%

Washington DC MSA Inventory A
Emission Inventory Summary - Air Toxics and SOx

				tpy		
Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
Lawn & Garden	115	65	175	70	1,201	62
Airport Service	290	13	12	6	8	171
Recreational	21	4	25	10	69	2
Recreational Marine	96	15	49	21	237	16
Light Commercial	44	15	33	13	185	33
Industrial	93	20	11	5	34	58
Construction	2,113	328	75	39	80	1,555
Agricultural	435	72	15	8	11	185
Logging	3	1	3	1	13	0
Marine Vessels	ND	ND	ND	ND	ND	ND
Nonroad Engines and Vehicles	3,210	532	397	174	1,838	2,083
Highway Vehicles	ND	ND	ND	ND	ND	ND
Other Area and Point Sources	ND	ND	ND	ND	ND	ND
All Sources	NA	NA	NA	NA	NA	NA

Washington DC MSA Inventory A
Emission Inventory Summary - Air Toxics and SOx
Percent of Total Inventory

				% total tpy		
Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
Lawn & Garden	NA	NA	NA	NA	NA	NA
Airport Service	NA	NA	NA	NA	NA	NA
Recreational	NA	NA	NA	NA	NA	NA
Recreational Marine	NA	NA	NA	NA	NA	NA
Light Commercial	NA	NA	NA	NA	NA	NA
Industrial	NA	NA	NA	NA	NA	NA
Construction	NA	NA	NA	NA	NA	NA
Agricultural	NA	NA	NA	NA	NA	NA
Logging	NA	NA	NA	NA	NA	NA
Marine Vessels	NA	NA	NA	NA	NA	NA
Nonroad Engines and Vehicles	NA	NA	NA	NA	NA	NA
Highway Vehicles	NA	NA	NA	NA	NA	NA
Other Area and Point Sources	NA	NA	NA	NA	NA	NA
All Sources	NA	NA	NA	NA	NA	NA

USA Inventory A (in-use est.)
Emission Inventory Summary - VOC, NOx, CO

Equipment Category	tpy VOC	tpy NOx	tpy CO	tpsd VOC	tpsd NOx	tpwd CO
Lawn & Garden	865,540	13,758	6,761,335	3,365	59	4,425
Airport Service	17,046	104,233	151,433	47	286	415
Recreational	726,252	5,208	1,374,127	781	5	9,255
Recreational Marine	1,551,131	87,573	4,593,912	9,558	547	1.007
Light Commercial	165,960	30,233	3,694,644	461	83	10,122
Industrial	98,624	237,897	1,393,952	276	652	3,819
Construction	160,554	1,024,797	998,354	669	4,268	1,641
Agricultural	219,061	935,457	1,072,551	960	4,101	705
Logging	29,450	77,830	190,494	81	213	522
Marine Vessels	543,464	218,799	1,822,527	1,489	599	4,993
Nonroad Engines and Vehicles	4,377,082	2,735,785	22,053,329	17,686	10,813	36,905
Highway Vehicles	5,639,454	6,547,763	36,034,743	16,996	19,733	84,904
Other Area and Point Sources	13,684,163	13,955,333	24,460,414	37,491	38,234	87,207
All Sources	23,700,699	23,238,881	82,548,486	72,173	68,780	209,015

USA Inventory A (in-use est.)
Emission Inventory Summary - VOC, NOx, CO
Percent of Total Inventory

Equipment Category	% total tpy VOC	% total tpy NOx	% total tpy CO	% total tpsd VOC	% total tpsd NOx	% total tpwd CO
Lawn & Garden	3.65%	0.06%	8.19%	4.66%	0.09%	2.12%
Airport Service	0.07%	0.45%	0.18%	0.06%	0.42%	0.20%
Recreational	3.06%	0.02%	1.66%	1.08%	0.01%	4.43%
Recreational Marine	6.54%	0.38%	5.57%	13.24%	0.80%	0.48%
Light Commercial	0.70%	0.13%	4.48%	0.64%	0.12%	4.84%
Industrial	0.42%	1.02%	1.69%	0.38%	0.95%	1.83%
Construction	0.68%	4.41%	1.21%	0.93%	6.20%	0.79%
Agricultural	0.92%	4.03%	1.30%	1.33%	5.96%	0.34%
Logging	0.12%	0.33%	0.23%	0.11%	0.31%	0.25%
Marine Vessels	2.29%	0.94%	2.21%	2.06%	0.87%	2.39%
Nonroad Engines and Vehicles	18.47%	11.77%	26.72%	24.51%	15.72%	17.66%
Highway Vehicles	23.79%	28.18%	43.65%	23.55%	28.69%	40.62%
Other Area and Point Sources	57.74%	60.05%	29.63%	51.95%	55.59%	41.72%
All Sources	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

USA Inventory A (in-use est.)
Emission Inventory Summary - Air Toxics and SOx

				tpy		
Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
Lawn & Garden	14,677	4,459	24,289	10,159	84,326	4,161
Airport Service	11,679	529	506	252	315	6,892
Recreational	13,239	1,481	21,415	9,217	17,275	579
Recreational Marine	73,714	8,840	44,103	18,969	92,718	9,146
Light Commercial	4,518	1,468	4,602	1,851	24,424	4,366
Industrial	19,065	4,037	2,808	1,246	7,081	11,901
Construction	121,417	18,844	4,733	2,403	4,578	89,303
Agricultural	172,194	28,257	6,469	3,343	4,441	73,063
Logging	10,689	1,522	858	376	1,889	6,481
Marine Vessels	16,204	ND	ND	ND	ND	24,604
Nonroad Engines and Vehicles	457,396	69,438	109,783	47,816	237,048	230,495
Highway Vehicles	1,397,738	ND	ND	ND	ND	652,572
Other Area and Point Sources	6,384,620	ND	ND	ND	ND	22,311,998
All Sources	8,239,754	NA	NA	NA	NA	23,195,065

USA Inventory A (in-use est.)
Emission Inventory Summary - Air Toxics and SOx
Percent of Total Inventory

				% total tpy		
Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
Lawn & Garden	0.18%	NA	NA	NA	NA	0.02%
Airport Service	0.14%	NA	NA	NA	NA	0.03%
Recreational	0.16%	NA	NA	NA	NA	0.00%
Recreational Marine	0.89%	NA	NA	NA	NA	0.04%
Light Commercial	0.05%	NA	NA	NA	NA	0.02%
Industrial	0.23%	NA	NA	NA	NA	0.05%
Construction	1.47%	NA	NA	NA	NA	0.39%
Agricultural	2.09%	NA	NA	NA	NA	0.31%
Logging	0.13%	NA	NA	NA	NA	0.03%
Marine Vessels	0.20%	NA	NA	NA	NA	0.11%
Nonroad Engines and Vehicles	5.55%	NA	NA	NA	NA	0.99%
Highway Vehicles	16.96%	NA	NA	NA	NA	2.81%
Other Area and Point Sources	77.49%	NA	NA	NA	NA	96.19%
All Sources	100.00%	NA	NA	NA	NA	100.00%

Atlanta MSA Inventory A (in-use est.)
Emission Inventory Summary - VOC, NOx, CO

	tpy			tpsd		tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	12,439	188	96,594	44	1	76
Airport Service	339	2,073	3,009	1	6	8
Recreational	730	5	2,603	3	0	5
Recreational Marine	6,513	354	18,470	34	2	14
Light Commercial	2,258	263	31,480	6	1	86
Industrial	661	1,578	9,275	2	4	25
Construction	2,240	14,176	14,025	8	51	31
Agricultural	363	1,559	1,786	1	6	1
Logging	308	1	889	1	0	2
Marine Vessels	0	0	ND	0	0	ND
Nonroad Engines and Vehicles	25,850	20,196	178,132	100	70	250
Highway Vehicles	ND	69,146	ND	319	208	ND
Other Area and Point Sources	ND	92,553	ND	287	248	ND
All Sources	NA	181,895	NA	706	527	NA

Atlanta MSA Inventory A (in-use est.)
Emission Inventory Summary - VOC, NOx, CO
Percent of Total Inventory

	% total tpy			% total tpsd		% total tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	NA	0.10%	NA	6.17%	0.13%	NA
Airport Service	NA	1.14%	NA	0.13%	1.08%	NA
Recreational	NA	0.00%	NA	0.40%	0.00%	NA
Recreational Marine	NA	0.19%	NA	4.83%	0.35%	NA
Light Commercial	NA	0.14%	NA	0.88%	0.14%	NA
Industrial	NA	0.87%	NA	0.26%	0.82%	NA
Construction	NA	7.79%	NA	1.15%	9.73%	NA
Agricultural	NA	0.86%	NA	0.19%	1.10%	NA
Logging	NA	0.00%	NA	0.12%	0.00%	NA
Marine Vessels	NA	0.00%	NA	0.00%	0.00%	NA
Nonroad Engines and Vehicles	NA	11.10%	NA	14.13%	13.35%	NA
Highway Vehicles	NA	38.01%	NA	45.19%	39.54%	NA
Other Area and Point Sources	NA	50.88%	NA	40.68%	47.10%	NA
All Sources	NA	100.00%	NA	100.00%	100.00%	NA

Atlanta MSA Inventory A (in-use est.)
Emission Inventory Summary - Air Toxics and SOx

	tpy					
Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
Lawn & Garden	209	64	354	148	1,068	58
Airport Service	232	11	10	5	6	137
Recreational	7	2	21	9	43	1
Recreational Marine	316	36	186	80	348	38
Light Commercial	55	16	65	27	209	38
Industrial	127	27	19	8	46	79
Construction	1,671	260	66	33	63	1,236
Agricultural	287	47	11	6	7	122
Logging	12	1	9	4	17	0
Marine Vessels	ND	ND	ND	ND	ND	ND
Nonroad Engines and Vehicles	2,917	464	740	320	1,807	1,709
Highway Vehicles	ND	ND	ND	ND	ND	ND
Other Area and Point Sources	ND	ND	ND	ND	ND	ND
All Sources	NA	NA	NA	NA	NA	NA

Atlanta MSA Inventory A (in-use est.)
Emission Inventory Summary - Air Toxics and SOx
Percent of Total Inventory

	% total tpy					
Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
Lawn & Garden	NA	NA	NA	NA	NA	NA
Airport Service	NA	NA	NA	NA	NA	NA
Recreational	NA	NA	NA	NA	NA	NA
Recreational Marine	NA	NA	NA	NA	NA	NA
Light Commercial	NA	NA	NA	NA	NA	NA
Industrial	NA	NA	NA	NA	NA	NA
Construction	NA	NA	NA	NA	NA	NA
Agricultural	NA	NA	NA	NA	NA	NA
Logging	NA	NA	NA	NA	NA	NA
Marine Vessels	NA	NA	NA	NA	NA	NA
Nonroad Engines and Vehicles	NA	NA	NA	NA	NA	NA
Highway Vehicles	NA	NA	NA	NA	NA	NA
Other Area and Point Sources	NA	NA	NA	NA	NA	NA
All Sources	NA	NA	NA	NA	NA	NA

Baltimore MSA Inventory A (in-use est.)
Emission Inventory Summary - VOC, NOx, CO

	tpy			tpsd		tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	7,487	120	59,199	29	1	37
Airport Service	321	1,962	2,855	1	5	8
Recreational	1,304	9	2,468	1	0	17
Recreational Marine	2,614	250	9,730	16	2	2
Light Commercial	1,819	192	24,055	5	1	66
Industrial	575	1,387	8,122	2	4	22
Construction	1,452	9,268	9,029	6	39	15
Agricultural	479	2,044	2,343	2	9	2
Logging	159	0	460	0	0	1
Marine Vessels	1,623	5,970	30,332	4	16	83
Nonroad Engines and Vehicles	17,833	21,203	148,593	67	76	252
Highway Vehicles	ND	54,317	ND	200	164	1,328
Other Area and Point Sources	ND	59,976	34,462	226	164	226
All Sources	NA	135,496	NA	493	404	1,805

Baltimore MSA Inventory A (in-use est.)
Emission Inventory Summary - VOC, NOx, CO
Percent of Total Inventory

	% total tpy			% total tpsd		% total tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	NA	0.09%	NA	5.96%	0.13%	2.03%
Airport Service	NA	1.45%	NA	0.18%	1.33%	0.43%
Recreational	NA	0.01%	NA	0.28%	0.00%	0.92%
Recreational Marine	NA	0.18%	NA	3.18%	0.39%	0.12%
Light Commercial	NA	0.14%	NA	1.02%	0.13%	3.65%
Industrial	NA	1.02%	NA	0.33%	0.94%	1.23%
Construction	NA	6.84%	NA	1.23%	9.56%	0.82%
Agricultural	NA	1.51%	NA	0.43%	2.22%	0.09%
Logging	NA	0.00%	NA	0.09%	0.00%	0.07%
Marine Vessels	NA	4.41%	NA	0.90%	4.05%	4.60%
Nonroad Engines and Vehicles	NA	15.65%	NA	13.59%	18.75%	13.96%
Highway Vehicles	NA	40.09%	NA	40.57%	40.55%	73.53%
Other Area and Point Sources	NA	44.26%	NA	45.84%	40.70%	12.51%
All Sources	NA	100.00%	NA	100.00%	100.00%	100.00%

Baltimore MSA Inventory A (in-use est.)
Emission Inventory Summary - Air Toxics and SOx

				tpy		
Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
Lawn & Garden	128	39	210	88	734	36
Airport Service	220	10	10	5	6	130
Recreational	24	3	38	17	31	1
Recreational Marine	104	19	68	29	384	21
Light Commercial	43	13	52	22	156	28
Industrial	111	24	16	7	41	69
Construction	1,098	170	43	22	41	808
Agricultural	376	62	14	7	10	160
Logging	6	1	5	2	9	0
Marine Vessels	302	ND	ND	ND	ND	1,719
Nonroad Engines and Vehicles	2,412	340	456	198	1,412	2,971
Highway Vehicles	ND	ND	ND	ND	ND	ND
Other Area and Point Sources	ND	ND	ND	ND	ND	ND
All Sources	NA	NA	NA	NA	NA	NA

Baltimore MSA Inventory A (in-use est.)
Emission Inventory Summary - Air Toxics and SOx
Percent of Total Inventory

				% total tpy		
Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
Lawn & Garden	NA	NA	NA	NA	NA	NA
Airport Service	NA	NA	NA	NA	NA	NA
Recreational	NA	NA	NA	NA	NA	NA
Recreational Marine	NA	NA	NA	NA	NA	NA
Light Commercial	NA	NA	NA	NA	NA	NA
Industrial	NA	NA	NA	NA	NA	NA
Construction	NA	NA	NA	NA	NA	NA
Agricultural	NA	NA	NA	NA	NA	NA
Logging	NA	NA	NA	NA	NA	NA
Marine Vessels	NA	NA	NA	NA	NA	NA
Nonroad Engines and Vehicles	NA	NA	NA	NA	NA	NA
Highway Vehicles	NA	NA	NA	NA	NA	NA
Other Area and Point Sources	NA	NA	NA	NA	NA	NA
All Sources	NA	NA	NA	NA	NA	NA

Baton Rouge CMSA Inventory A (in-use est.)
Emission Inventory Summary - VOC, NOx, CO

		tpy		tpsd		tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	1,983	34	17,256	7	0	12
Airport Service	247	1,510	2,190	1	4	6
Recreational	624	4	2,225	3	0	3
Recreational Marine	3,276	108	7,064	17	1	5
Light Commercial	908	106	12,658	3	0	35
Industrial	165	394	2,313	0	1	6
Construction	1,116	7,061	6,986	4	26	15
Agricultural	120	518	593	0	2	0
Logging	42	129	307	0	0	1
Marine Vessels	108	1,849	394	0	5	1
Nonroad Engines and Vehicles	8,588	11,713	51,987	35	39	85
Highway Vehicles	ND	14,555	ND	64	44	ND
Other Area and Point Sources	ND	82,744	ND	270	227	ND
All Sources	NA	109,012	NA	369	310	NA

Baton Rouge CMSA Inventory A (in-use est.)
Emission Inventory Summary - VOC, NOx, CO
Percent of Total Inventory

		% total tpy		% total tpsd		% total tpw
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	NA	0.03%	NA	1.94%	0.04%	NA
Airport Service	NA	1.39%	NA	0.18%	1.34%	NA
Recreational	NA	0.00%	NA	0.69%	0.01%	NA
Recreational Marine	NA	0.10%	NA	4.64%	0.18%	NA
Light Commercial	NA	0.10%	NA	0.68%	0.09%	NA
Industrial	NA	0.36%	NA	0.12%	0.35%	NA
Construction	NA	6.48%	NA	1.09%	8.25%	NA
Agricultural	NA	0.47%	NA	0.12%	0.62%	NA
Logging	NA	0.12%	NA	0.03%	0.11%	NA
Marine Vessels	NA	1.70%	NA	0.08%	1.64%	NA
Nonroad Engines and Vehicles	NA	10.74%	NA	9.59%	12.63%	NA
Highway Vehicles	NA	13.35%	NA	17.32%	14.17%	NA
Other Area and Point Sources	NA	75.90%	NA	73.09%	73.21%	NA
All Sources	NA	100.00%	NA	100.00%	100.00%	NA

Baton Rouge CMSA Inventory A (in-use est.)
Emission Inventory Summary - Air Toxics and SOx

Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
	tpy					
Lawn & Garden	37	11	56	23	179	11
Airport Service	169	8	7	4	4	100
Recreational	6	2	18	8	37	1
Recreational Marine	170	14	95	41	134	15
Light Commercial	22	7	26	11	84	15
Industrial	32	7	5	2	12	20
Construction	832	130	33	17	31	616
Agricultural	95	16	4	2	2	40
Logging	17	2	1	1	3	11
Marine Vessels	109	ND	ND	ND	ND	739
Nonroad Engines and Vehicles	1,491	195	245	107	486	1,568
Highway Vehicles	ND	ND	ND	ND	ND	ND
Other Area and Point Sources	ND	ND	ND	ND	ND	ND
All Sources	NA	NA	NA	NA	NA	NA

Baton Rouge CMSA Inventory A (in-use est.)
Emission Inventory Summary - Air Toxics and SOx
Percent of Total Inventory

Equipment Category	PM	Aldehydes	Benzene	1,3 But	Gas. Vap.	SOx
	% total tpy					
Lawn & Garden	NA	NA	NA	NA	NA	NA
Airport Service	NA	NA	NA	NA	NA	NA
Recreational	NA	NA	NA	NA	NA	NA
Recreational Marine	NA	NA	NA	NA	NA	NA
Light Commercial	NA	NA	NA	NA	NA	NA
Industrial	NA	NA	NA	NA	NA	NA
Construction	NA	NA	NA	NA	NA	NA
Agricultural	NA	NA	NA	NA	NA	NA
Logging	NA	NA	NA	NA	NA	NA
Marine Vessels	NA	NA	NA	NA	NA	NA
Nonroad Engines and Vehicles	NA	NA	NA	NA	NA	NA
Highway Vehicles	NA	NA	NA	NA	NA	NA
Other Area and Point Sources	NA	NA	NA	NA	NA	NA
All Sources	NA	NA	NA	NA	NA	NA

Boston CMSA Inventory A (in-use est.)
Emission Inventory Summary - VOC, NOx, CO

	tpy			tpsd		tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	7,337	135	59,922	37	1	26
Airport Service	409	2,496	3,630	1	7	10
Recreational	6,051	44	10,220	4	0	84
Recreational Marine	2,446	134	6,907	17	1	1
Light Commercial	4,389	423	55,357	12	1	152
Industrial	1,802	4,400	25,659	5	12	70
Construction	1,825	11,786	11,235	9	56	12
Agricultural	129	546	626	1	3	0
Logging	117	0	339	0	0	1
Marine Vessels	ND	ND	ND	0	5	1
Nonroad Engines and Vehicles	24,505	19,964	173,896	86	85	357
Highway Vehicles	ND	ND	ND	415	207	1,470
Other Area and Point Sources	ND	ND	ND	304	169	599
All Sources	NA	NA	NA	806	461	2,425

Boston CMSA Inventory A (in-use est.)
Emission Inventory Summary - VOC, NOx, CO
Percent of Total Inventory

	% total tpy			% total tpsd		% total tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	NA	NA	NA	4.58%	0.16%	1.06%
Airport Service	NA	NA	NA	0.14%	1.48%	0.41%
Recreational	NA	NA	NA	0.52%	0.01%	3.46%
Recreational Marine	NA	NA	NA	2.12%	0.22%	0.03%
Light Commercial	NA	NA	NA	1.50%	0.25%	6.25%
Industrial	NA	NA	NA	0.63%	2.62%	2.90%
Construction	NA	NA	NA	1.07%	12.05%	0.51%
Agricultural	NA	NA	NA	0.09%	0.65%	0.02%
Logging	NA	NA	NA	0.04%	0.00%	0.04%
Marine Vessels	NA	NA	NA	0.03%	1.08%	0.03%
Nonroad Engines and Vehicles	NA	NA	NA	10.71%	18.51%	14.70%
Highway Vehicles	NA	NA	NA	51.50%	44.90%	60.62%
Other Area and Point Sources	NA	NA	NA	37.79%	36.59%	24.68%
All Sources	NA	NA	NA	100.00%	100.00%	100.00%

Boston CMSA Inventory A (in-use est.)
Emission Inventory Summary - Air Toxics and SOx

Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
	tpy					
Lawn & Garden	128	39	201	84	884	38
Airport Service	280	13	12	6	8	165
Recreational	117	12	179	77	108	4
Recreational Marine	101	13	62	26	411	13
Light Commercial	100	30	126	53	351	62
Industrial	352	74	51	23	133	220
Construction	1,406	217	54	27	53	1,026
Agricultural	100	17	4	2	3	43
Logging	5	1	3	1	6	0
Marine Vessels	173	ND	ND	ND	ND	ND
Nonroad Engines and Vehicles	2,760	415	692	300	1,956	1,572
Highway Vehicles	ND	ND	ND	ND	ND	ND
Other Area and Point Sources	ND	ND	ND	ND	ND	ND
All Sources	NA	NA	NA	NA	NA	NA

Boston CMSA Inventory A (in-use est.)
Emission Inventory Summary - Air Toxics and SOx
Percent of Total Inventory

Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
	% total tpy					
Lawn & Garden	NA	NA	NA	NA	NA	NA
Airport Service	NA	NA	NA	NA	NA	NA
Recreational	NA	NA	NA	NA	NA	NA
Recreational Marine	NA	NA	NA	NA	NA	NA
Light Commercial	NA	NA	NA	NA	NA	NA
Industrial	NA	NA	NA	NA	NA	NA
Construction	NA	NA	NA	NA	NA	NA
Agricultural	NA	NA	NA	NA	NA	NA
Logging	NA	NA	NA	NA	NA	NA
Marine Vessels	NA	NA	NA	NA	NA	NA
Nonroad Engines and Vehicles	NA	NA	NA	NA	NA	NA
Highway Vehicles	NA	NA	NA	NA	NA	NA
Other Area and Point Sources	NA	NA	NA	NA	NA	NA
All Sources	NA	NA	NA	NA	NA	NA

Chicago CMSA Inventory A (in-use est.)
Emission Inventory Summary - VOC, NOx, CO

	tpy			tpsd		tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	13,248	251	110,726	66	1	48
Airport Service	828	5,063	7,355	2	14	20
Recreational	9,009	65	15,216	7	0	122
Recreational Marine	3,384	131	7,698	24	1	0
Light Commercial	7,409	714	93,402	20	2	256
Industrial	3,466	8,447	49,307	10	23	135
Construction	3,743	24,167	23,030	18	114	25
Agricultural	807	3,406	3,912	4	19	3
Logging	168	0	485	0	0	1
Marine Vessels	ND	608	ND	1	26	ND
Nonroad Engines and Vehicles	42,061	42,852	311,131	154	200	611
Highway Vehicles	ND	153,215	ND	588	462	ND
Other Area and Point Sources	ND	302,107	ND	1,029	603	ND
All Sources	NA	498,174	NA	1,770	1,265	NA

Chicago CMSA Inventory A (in-use est.)
Emission Inventory Summary - VOC, NOx, CO
Percent of Total Inventory

	% total tpy			% total tpsd		% total tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	NA	0.05%	NA	3.75%	0.11%	NA
Airport Service	NA	1.02%	NA	0.13%	1.10%	NA
Recreational	NA	0.01%	NA	0.38%	0.00%	NA
Recreational Marine	NA	0.03%	NA	1.37%	0.08%	NA
Light Commercial	NA	0.14%	NA	1.16%	0.15%	NA
Industrial	NA	1.70%	NA	0.55%	1.83%	NA
Construction	NA	4.85%	NA	1.00%	9.00%	NA
Agricultural	NA	0.68%	NA	0.25%	1.47%	NA
Logging	NA	0.00%	NA	0.03%	0.00%	NA
Marine Vessels	NA	0.12%	NA	0.07%	2.09%	NA
Nonroad Engines and Vehicles	NA	8.60%	NA	8.68%	15.84%	NA
Highway Vehicles	NA	30.76%	NA	33.20%	36.50%	NA
Other Area and Point Sources	NA	60.64%	NA	58.12%	47.66%	NA
All Sources	NA	100.00%	NA	100.00%	100.00%	NA

Chicago CMSA Inventory A (in-use et.)
Emission Inventory Summary - Air Toxics and SOx

Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
	tpy					
Lawn & Garden	237	71	360	151	1,658	71
Airport Service	567	26	25	12	16	335
Recreational	174	17	267	115	164	7
Recreational Marine	148	15	86	37	546	16
Light Commercial	168	51	213	89	596	105
Industrial	674	13	98	44	260	421
Construction	2,885	46	110	56	110	2,104
Agricultural	626	13	24	12	20	266
Logging	6	1	5	2	9	0
Marine Vessels	300	ND	ND	ND	ND	ND
Nonroad Engines and Vehicles	5,786	82	1,187	518	3,378	3,325
Highway Vehicles	113,525	ND	ND	ND	ND	ND
Other Area and Point Sources	181,246	ND	ND	ND	ND	ND
All Sources	300,557	IA	NA	NA	NA	NA

Chicago CMSA Inventory A (in-use et.)
Emission Inventory Summary - Air Toxics and SOx
Percent of Total Inventory

Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
	% total tpy					
Lawn & Garden	0.08%	IA	NA	NA	NA	NA
Airport Service	0.19%	IA	NA	NA	NA	NA
Recreational	0.06%	IA	NA	NA	NA	NA
Recreational Marine	0.05%	IA	NA	NA	NA	NA
Light Commercial	0.06%	IA	NA	NA	NA	NA
Industrial	0.22%	IA	NA	NA	NA	NA
Construction	0.96%	IA	NA	NA	NA	NA
Agricultural	0.21%	IA	NA	NA	NA	NA
Logging	0.00%	IA	NA	NA	NA	NA
Marine Vessels	0.10%	IA	NA	NA	NA	NA
Nonroad Engines and Vehicles	1.93%	IA	NA	NA	NA	NA
Highway Vehicles	37.77%	IA	NA	NA	NA	NA
Other Area and Point Sources	60.30%	IA	NA	NA	NA	NA
All Sources	100.00%	IA	NA	NA	NA	NA

Cleveland CMSA Inventory A (in-use est.)
Emission Inventory Summary - VOC, NOx, CO

	tpy			tpsd		tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	4,989	94	41,586	25	1	18
Airport Service	352	2,151	3,118	1	6	9
Recreational	1,364	10	2,305	1	0	19
Recreational Marine	1,496	110	4,424	11	1	0
Light Commercial	2,970	286	37,440	8	1	103
Industrial	1,619	3,945	23,028	5	11	63
Construction	1,285	8,298	7,908	6	39	9
Agricultural	367	1,550	1,781	2	8	1
Logging	65	0	187	0	0	1
Marine Vessels	1,003	109	3,757	3	0	ND
Nonroad Engines and Vehicles	15,510	16,554	125,533	61	67	221
Highway Vehicles	ND	64,808	412,340	242	195	2,360
Other Area and Point Sources	ND	62,301	88,401	369	171	252
All Sources	NA	143,663	626,274	672	433	2,833

Cleveland CMSA Inventory A (in-use est.)
Emission Inventory Summary - VOC, NOx, CO
Percent of Total Inventory

	% total tpy			% total tpsd		% total tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	NA	0.07%	6.64%	3.72%	0.12%	0.64%
Airport Service	NA	1.50%	0.50%	0.14%	1.36%	0.30%
Recreational	NA	0.01%	0.37%	0.15%	0.00%	0.65%
Recreational Marine	NA	0.08%	0.71%	1.58%	0.20%	0.00%
Light Commercial	NA	0.20%	5.98%	1.22%	0.18%	3.62%
Industrial	NA	2.75%	3.68%	0.67%	2.50%	2.23%
Construction	NA	5.78%	1.26%	0.90%	9.04%	0.31%
Agricultural	NA	1.08%	0.28%	0.30%	1.96%	0.04%
Logging	NA	0.00%	0.03%	0.03%	0.00%	0.02%
Marine Vessels	NA	0.08%	0.60%	0.41%	0.07%	0.00%
Nonroad Engines and Vehicles	NA	11.52%	20.04%	9.13%	15.42%	7.81%
Highway Vehicles	NA	45.11%	65.84%	35.97%	45.13%	83.31%
Other Area and Point Sources	NA	43.37%	14.12%	54.90%	39.44%	8.88%
All Sources	NA	100.00%	100.00%	100.00%	100.00%	100.00%

Cleveland CMSA Inventory A (in-use est.)
Emission Inventory Summary - Air Toxics and SOx

				tpy		
Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
Lawn & Garden	89	27	136	57	623	27
Airport Service	241	11	10	5	7	142
Recreational	26	3	40	17	25	1
Recreational Marine	60	9	37	16	277	10
Light Commercial	67	20	85	36	239	42
Industrial	315	67	46	20	121	197
Construction	990	153	38	19	38	723
Agricultural	285	47	11	6	9	121
Logging	2	0	2	1	4	0
Marine Vessels	ND	ND	ND	ND	ND	ND
Nonroad Engines and Vehicles	2,077	336	405	177	1,342	1,262
Highway Vehicles	46,729	ND	ND	ND	ND	ND
Other Area and Point Sources	64,287	ND	ND	ND	ND	ND
All Sources	113,093	NA	NA	NA	NA	NA

Cleveland CMSA Inventory A (in-use est.)
Emission Inventory Summary - Air Toxics and SOx
Percent of Total Inventory

				% total tpy		
Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
Lawn & Garden	0.08%	NA	NA	NA	NA	NA
Airport Service	0.21%	NA	NA	NA	NA	NA
Recreational	0.02%	NA	NA	NA	NA	NA
Recreational Marine	0.05%	NA	NA	NA	NA	NA
Light Commercial	0.06%	NA	NA	NA	NA	NA
Industrial	0.28%	NA	NA	NA	NA	NA
Construction	0.88%	NA	NA	NA	NA	NA
Agricultural	0.25%	NA	NA	NA	NA	NA
Logging	0.00%	NA	NA	NA	NA	NA
Marine Vessels	0.00%	NA	NA	NA	NA	NA
Nonroad Engines and Vehicles	1.84%	NA	NA	NA	NA	NA
Highway Vehicles	41.32%	NA	NA	NA	NA	NA
Other Area and Point Sources	56.84%	NA	NA	NA	NA	NA
All Sources	100.00%	NA	NA	NA	NA	NA

Denver CMSA Inventory A (in-use est.)
Emission Inventory Summary - VOC, NOx, CO

	tpy			tpsd		tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	6,942	133	61,571	36	1	18
Airport Service	260	1,591	2,309	1	4	6
Recreational	3,848	28	6,826	3	0	50
Recreational Marine	1,354	77	4,257	10	1	0
Light Commercial	3,600	380	47,518	10	1	130
Industrial	920	2,217	12,983	3	6	36
Construction	1,925	12,353	12,005	9	58	13
Agricultural	208	895	999	1	5	1
Logging	61	0	176	0	0	0
Marine Vessels	ND	ND	0	ND	ND	0
Nonroad Engines and Vehicles	19,118	17,674	148,644	73	76	255
Highway Vehicles	ND	ND	417,406	ND	ND	2,371
Other Area and Point Sources	ND	ND	58,870	ND	ND	168
All Sources	NA	NA	624,920	NA	NA	2,794

Denver CMSA Inventory A (in-use est.)
Emission Inventory Summary - VOC, NOx, CO
Percent of Total Inventory

	% total tpy			% total tpsd		% total tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	NA	NA	9.85%	NA	NA	0.65%
Airport Service	NA	NA	0.37%	NA	NA	0.23%
Recreational	NA	NA	1.09%	NA	NA	1.80%
Recreational Marine	NA	NA	0.68%	NA	NA	0.00%
Light Commercial	NA	NA	7.60%	NA	NA	4.66%
Industrial	NA	NA	2.08%	NA	NA	1.27%
Construction	NA	NA	1.92%	NA	NA	0.47%
Agricultural	NA	NA	0.16%	NA	NA	0.02%
Logging	NA	NA	0.03%	NA	NA	0.02%
Marine Vessels	NA	NA	0.00%	NA	NA	0.00%
Nonroad Engines and Vehicles	NA	NA	23.79%	NA	NA	9.12%
Highway Vehicles	NA	NA	66.79%	NA	NA	84.88%
Other Area and Point Sources	NA	NA	9.42%	NA	NA	6.00%
All Sources	NA	NA	100.00%	NA	NA	100.00%

Denver CMSA Inventory A (in-use est.)
Emission Inventory Summary - Air Toxics and SOx

Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
			tpy			
Lawn & Garden	129	39	191	80	790	39
Airport Service	178	8	8	4	5	105
Recreational	73	8	114	49	77	3
Recreational Marine	60	8	37	16	132	8
Light Commercial	84	25	103	43	310	55
Industrial	178	38	26	12	67	111
Construction	1,464	227	57	29	55	1,077
Agricultural	165	27	6	3	4	70
Logging	2	0	2	1	3	0
Marine Vessels	ND	ND	ND	ND	ND	ND
Nonroad Engines and Vehicles	2,333	380	544	236	1,444	1,467
Highway Vehicles	32,716	ND	ND	ND	ND	ND
Other Area and Point Sources	146,677	ND	ND	ND	ND	ND
All Sources	181,726	NA	NA	NA	NA	NA

Denver CMSA Inventory A (in-use est.)
Emission Inventory Summary - Air Toxics and SOx
Percent of Total Inventory

Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
			% total tpy			
Lawn & Garden	0.07%	NA	NA	NA	NA	NA
Airport Service	0.10%	NA	NA	NA	NA	NA
Recreational	0.04%	NA	NA	NA	NA	NA
Recreational Marine	0.03%	NA	NA	NA	NA	NA
Light Commercial	0.05%	NA	NA	NA	NA	NA
Industrial	0.10%	NA	NA	NA	NA	NA
Construction	0.81%	NA	NA	NA	NA	NA
Agricultural	0.09%	NA	NA	NA	NA	NA
Logging	0.00%	NA	NA	NA	NA	NA
Marine Vessels	0.00%	NA	NA	NA	NA	NA
Nonroad Engines and Vehicles	1.28%	NA	NA	NA	NA	NA
Highway Vehicles	18.00%	NA	NA	NA	NA	NA
Other Area and Point Sources	80.71%	NA	NA	NA	NA	NA
All Sources	100.00%	NA	NA	NA	NA	NA

El Paso MSA Inventory A (in-use est.)
Emission Inventory Summary - VOC, NOx, CO

	tpy			tpsd		tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	1,533	28	13,791	6	0	9
Airport Service	77	470	688	0	1	2
Recreational	562	4	1,985	2	0	3
Recreational Marine	0	0	0	0	0	0
Light Commercial	888	107	12,471	2	0	34
Industrial	332	795	4,668	1	2	13
Construction	524	3,288	3,295	2	12	7
Agricultural	41	179	201	0	1	0
Logging	9	0	26	0	0	0
Marine Vessels	0	0	0	0	0	0
Nonroad Engines and Vehicles	3,966	4,870	37,126	14	16	68
Highway Vehicles	ND	11,156	320,700	36	34	756
Other Area and Point Sources	ND	20,382	18,000	60	25	24
All Sources	NA	36,408	375,826	110	75	848

El Paso MSA Inventory A (in-use est.)
Emission Inventory Summary - VOC, NOx, CO
Percent of Total Inventory

	% total tpy			% total tpsd		% total tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	NA	0.08%	3.67%	5.15%	0.14%	1.11%
Airport Service	NA	1.29%	0.18%	0.19%	1.72%	0.22%
Recreational	NA	0.01%	0.53%	2.08%	0.02%	0.31%
Recreational Marine	NA	0.00%	0.00%	0.00%	0.00%	0.00%
Light Commercial	NA	0.29%	3.32%	2.23%	0.39%	4.03%
Industrial	NA	2.18%	1.24%	0.84%	2.91%	1.51%
Construction	NA	9.03%	0.88%	1.73%	15.87%	0.85%
Agricultural	NA	0.49%	0.05%	0.14%	0.89%	0.02%
Logging	NA	0.00%	0.01%	0.02%	0.00%	0.01%
Marine Vessels	NA	0.00%	0.00%	0.00%	0.00%	0.00%
Nonroad Engines and Vehicles	NA	13.38%	9.88%	12.38%	21.93%	8.06%
Highway Vehicles	NA	30.64%	85.33%	33.03%	44.87%	89.08%
Other Area and Point Sources	NA	55.98%	4.79%	54.59%	33.19%	2.87%
All Sources	NA	100.00%	100.00%	100.00%	100.00%	100.00%

El Paso MSA   Inventory A (in-use est.)
Emission Inventory Summary - Air Toxics and SOx

				tpy		
Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
Lawn & Garden	31	9	43	18	142	8
Airport Service	53	2	2	1	1	31
Recreational	6	2	16	7	34	1
Recreational Marine	0	0	0	0	0	0
Light Commercial	22	6	25	11	81	15
Industrial	64	14	9	4	23	40
Construction	389	61	15	8	15	287
Agricultural	33	5	1	1	1	14
Logging	0	0	0	0	0	0
Marine Vessels	0	0	ND	ND	ND	0
Nonroad Engines and Vehicles	597	99	114	49	296	396
Highway Vehicles	7,278	ND	ND	ND	ND	ND
Other Area and Point Sources	129,939	ND	ND	ND	ND	ND
All Sources	137,814	NA	NA	NA	NA	NA

El Paso MSA   Inventory A (in-use est.)
Emission Inventory Summary - Air Toxics and SOx
Percent of Total Inventory

				% total tpy		
Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
Lawn & Garden	0.02%	NA	NA	NA	NA	NA
Airport Service	0.04%	NA	NA	NA	NA	NA
Recreational	0.00%	NA	NA	NA	NA	NA
Recreational Marine	0.00%	NA	NA	NA	NA	NA
Light Commercial	0.02%	NA	NA	NA	NA	NA
Industrial	0.05%	NA	NA	NA	NA	NA
Construction	0.28%	NA	NA	NA	NA	NA
Agricultural	0.02%	NA	NA	NA	NA	NA
Logging	0.00%	NA	NA	NA	NA	NA
Marine Vessels	0.00%	NA	NA	NA	NA	NA
Nonroad Engines and Vehicles	0.43%	NA	NA	NA	NA	NA
Highway Vehicles	5.28%	NA	NA	NA	NA	NA
Other Area and Point Sources	94.29%	NA	NA	NA	NA	NA
All Sources	100.00%	NA	NA	NA	NA	NA

Hartford NECMA Inventory A (in-use est.)
Emission Inventory Summary - VOC, NOx, CO

	tpy			tpsd		tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	2,825	45	20,741	14	0	9
Airport Service	294	1,800	2,615	1	5	7
Recreational	2,611	19	4,410	2	0	36
Recreational Marine	2,294	122	6,036	16	1	1
Light Commercial	1,074	104	13,549	3	0	37
Industrial	660	1,612	9,402	2	4	26
Construction	675	4,362	4,158	3	21	5
Agricultural	111	470	540	1	3	0
Logging	77	0	222	0	0	1
Marine Vessels	11	260	29	0	1	0
Nonroad Engines and Vehicles	10,633	8,796	61,702	42	35	121
Highway Vehicles	ND	29,311	108,380	189	88	590
Other Area and Point Sources	ND	11,650	51,997	77	18	210
All Sources	NA	49,757	222,079	307	141	921

Hartford NECMA Inventory A (in-use est.)
Emission Inventory Summary - VOC, NOx, CO
Percent of Total Inventory

	% total tpy			% total tpsd		% total tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	NA	0.09%	9.34%	4.68%	0.17%	0.93%
Airport Service	NA	3.62%	1.18%	0.26%	3.50%	0.78%
Recreational	NA	0.04%	1.99%	0.59%	0.01%	3.93%
Recreational Marine	NA	0.25%	2.72%	5.24%	0.65%	0.07%
Light Commercial	NA	0.21%	6.10%	0.96%	0.20%	4.03%
Industrial	NA	3.24%	4.23%	0.60%	3.13%	2.80%
Construction	NA	8.77%	1.87%	1.03%	14.57%	0.49%
Agricultural	NA	0.95%	0.24%	0.20%	1.83%	0.04%
Logging	NA	0.00%	0.10%	0.07%	0.00%	0.07%
Marine Vessels	NA	0.52%	0.01%	0.01%	0.50%	0.01%
Nonroad Engines and Vehicles	NA	17.68%	27.78%	13.65%	24.56%	13.15%
Highway Vehicles	NA	58.91%	48.80%	61.34%	62.62%	64.06%
Other Area and Point Sources	NA	23.41%	23.41%	25.01%	12.82%	22.80%
All Sources	NA	100.00%	100.00%	100.00%	100.00%	100.00%

Hartford NECMA Inventory A (in-use est.)
Emission Inventory Summary - Air Toxics and SOx

Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
	tpy					
Lawn & Garden	45	14	78	33	318	13
Airport Service	202	9	9	4	6	119
Recreational	50	5	77	33	46	2
Recreational Marine	99	12	59	25	352	13
Light Commercial	24	7	31	13	86	15
Industrial	129	27	19	8	49	80
Construction	520	80	20	10	20	380
Agricultural	86	14	3	2	3	37
Logging	3	0	2	1	4	0
Marine Vessels	ND	ND	ND	ND	ND	ND
Nonroad Engines and Vehicles	1,159	169	298	130	883	659
Highway Vehicles	ND	ND	ND	ND	ND	ND
Other Area and Point Sources	ND	ND	ND	ND	ND	ND
All Sources	NA	NA	NA	NA	NA	NA

Hartford NECMA Inventory A (in-use est.)
Emission Inventory Summary - Air Toxics and SOx
Percent of Total Inventory

Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
	% total tpy					
Lawn & Garden	NA	NA	NA	NA	NA	NA
Airport Service	NA	NA	NA	NA	NA	NA
Recreational	NA	NA	NA	NA	NA	NA
Recreational Marine	NA	NA	NA	NA	NA	NA
Light Commercial	NA	NA	NA	NA	NA	NA
Industrial	NA	NA	NA	NA	NA	NA
Construction	NA	NA	NA	NA	NA	NA
Agricultural	NA	NA	NA	NA	NA	NA
Logging	NA	NA	NA	NA	NA	NA
Marine Vessels	NA	NA	NA	NA	NA	NA
Nonroad Engines and Vehicles	NA	NA	NA	NA	NA	NA
Highway Vehicles	NA	NA	NA	NA	NA	NA
Other Area and Point Sources	NA	NA	NA	NA	NA	NA
All Sources	NA	NA	NA	NA	NA	NA

Houston CMSA Inventory A (in-use est.)
Emission Inventory Summary - VOC, NOx, CO

	tpy			tpsd		tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	19,757	343	171,863	72	1	121
Airport Service	448	2,739	3,982	1	8	11
Recreational	1,825	12	6,446	7	0	8
Recreational Marine	12,319	582	35,799	64	3	27
Light Commercial	8,004	963	112,459	22	3	308
Industrial	1,568	3,755	22,040	4	10	60
Construction	6,153	38,629	38,708	22	140	85
Agricultural	709	3,078	3,464	3	11	2
Logging	228	255	988	1	1	3
Marine Vessels	688	12,462	1,718	2	34	5
Nonroad Engines and Vehicles	51,697	62,818	397,465	199	211	631
Highway Vehicles	ND	100,865	ND	442	304	ND
Other Area and Point Sources	ND	440,925	ND	1,391	859	ND
All Sources	NA	604,608	NA	2,032	1,374	NA

Houston CMSA Inventory A (in-use est.)
Emission Inventory Summary - VOC, NOx, CO
Percent of Total Inventory

	% total tpy			% total tpsd		% total tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	NA	0.06%	NA	3.55%	0.09%	NA
Airport Service	NA	0.45%	NA	0.06%	0.55%	NA
Recreational	NA	0.00%	NA	0.36%	0.00%	NA
Recreational Marine	NA	0.10%	NA	3.17%	0.22%	NA
Light Commercial	NA	0.16%	NA	1.09%	0.19%	NA
Industrial	NA	0.62%	NA	0.22%	0.75%	NA
Construction	NA	6.39%	NA	1.10%	10.17%	NA
Agricultural	NA	0.51%	NA	0.13%	0.83%	NA
Logging	NA	0.04%	NA	0.03%	0.05%	NA
Marine Vessels	NA	2.06%	NA	0.09%	2.48%	NA
Nonroad Engines and Vehicles	NA	10.39%	NA	9.80%	15.34%	NA
Highway Vehicles	NA	16.38%	NA	21.77%	22.12%	NA
Other Area and Point Sources	NA	72.93%	NA	68.44%	62.54%	NA
All Sources	NA	100.00%	NA	100.00%	100.00%	NA

Houston CMSA Inventory A (in-use est.)
Emission Inventory Summary - Air Toxics and SOx

Equipment Category	PM	Aldehydes	Benzene	tpy 1,3 But.	Gas. Vap.	SOx
Lawn & Garden	382	111	559	234	1,798	105
Airport Service	307	14	13	7	3	181
Recreational	18	6	53	22	109	2
Recreational Marine	592	68	354	152	612	65
Light Commercial	198	58	229	95	729	138
Industrial	302	64	45	20	107	188
Construction	4,574	713	182	92	172	3,370
Agricultural	567	93	21	11	12	240
Logging	40	6	7	3	13	21
Marine Vessels	741	ND	ND	ND	ND	5,152
Nonroad Engines and Vehicles	7,721	1,133	1,462	635	3,560	9,464
Highway Vehicles	ND	ND	ND	ND	ND	ND
Other Area and Point Sources	ND	ND	ND	ND	ND	ND
All Sources	NA	NA	NA	NA	NA	NA

Houston CMSA Inventory A (in-use est.)
Emission Inventory Summary - Air Toxics and SOx
Percent of Total Inventory

Equipment Category	PM	Aldehydes	Benzene	% total tpy 1,3 But.	Gas. Vap.	SOx
Lawn & Garden	NA	NA	NA	NA	NA	NA
Airport Service	NA	NA	NA	NA	NA	NA
Recreational	NA	NA	NA	NA	NA	NA
Recreational Marine	NA	NA	NA	NA	NA	NA
Light Commercial	NA	NA	NA	NA	NA	NA
Industrial	NA	NA	NA	NA	NA	NA
Construction	NA	NA	NA	NA	NA	NA
Agricultural	NA	NA	NA	NA	NA	NA
Logging	NA	NA	NA	NA	NA	NA
Marine Vessels	NA	NA	NA	NA	NA	NA
Nonroad Engines and Vehicles	NA	NA	NA	NA	NA	NA
Highway Vehicles	NA	NA	NA	NA	NA	NA
Other Area and Point Sources	NA	NA	NA	NA	NA	NA
All Sources	NA	NA	NA	NA	NA	NA

Miami CMSA Inventory A (in-use est.)
Emission Inventory Summary - VOC, NOx, CO

Equipment Category	tpy			tpsd		tpwd
	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	9,803	183	90,734	36	1	62
Airport Service	202	1,239	1,794	1	3	5
Recreational	1,277	8	4,552	5	0	8
Recreational Marine	8,438	646	26,130	44	3	20
Light Commercial	2,651	309	36,972	7	1	101
Industrial	871	2,079	12,221	2	6	33
Construction	1,838	11,631	11,507	7	42	25
Agricultural	182	783	897	1	3	1
Logging	53	0	154	0	0	0
Marine Vessels	943	1,310	ND	3	4	ND
Nonroad Engines and Vehicles	26,258	18,188	184,962	105	63	256
Highway Vehicles	ND	63,266	ND	307	191	ND
Other Area and Point Sources	ND	35,464	ND	235	97	ND
All Sources	NA	116,918	NA	647	350	NA

Miami CMSA Inventory A (in-use est.)
Emission Inventory Summary - VOC, NOx, CO
Percent of Total Inventory

Equipment Category	% total tpy			% total tpsd		% total tpwd
	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	NA	0.16%	NA	5.60%	0.19%	NA
Airport Service	NA	1.06%	NA	0.09%	0.97%	NA
Recreational	NA	0.01%	NA	0.76%	0.01%	NA
Recreational Marine	NA	0.55%	NA	6.78%	0.97%	NA
Light Commercial	NA	0.26%	NA	1.13%	0.24%	NA
Industrial	NA	1.78%	NA	0.38%	1.63%	NA
Construction	NA	9.95%	NA	1.03%	12.00%	NA
Agricultural	NA	0.67%	NA	0.11%	0.83%	NA
Logging	NA	0.00%	NA	0.02%	0.00%	NA
Marine Vessels	NA	1.12%	NA	0.40%	1.02%	NA
Nonroad Engines and Vehicles	NA	15.56%	NA	16.28%	17.87%	NA
Highway Vehicles	NA	54.11%	NA	47.41%	54.41%	NA
Other Area and Point Sources	NA	30.33%	NA	36.31%	27.73%	NA
All Sources	NA	100.00%	NA	100.00%	100.00%	NA

Miami CMSA Inventory A (in-use est.)
Emission Inventory Summary - Air Toxics and SOx

Equipment Category	PM	Aldehydes	Benzene	tpy 1,3 But.	Gas. Vap.	SOx
Lawn & Garden	194	57	277	116	908	56
Airport Service	139	6	6	3	4	82
Recreational	13	4	37	16	76	2
Recreational Marine	391	51	234	101	707	60
Light Commercial	64	19	76	31	246	44
Industrial	167	35	25	11	61	104
Construction	1,371	213	54	27	52	1,014
Agricultural	144	24	5	3	3	61
Logging	2	0	2	1	3	0
Marine Vessels	ND	ND	ND	ND	ND	ND
Nonroad Engines and Vehicles	2,485	410	715	308	2,059	1,424
Highway Vehicles	ND	ND	ND	ND	ND	ND
Other Area and Point Sources	ND	ND	ND	ND	ND	ND
All Sources	NA	NA	NA	NA	NA	NA

Miami CMSA Inventory A (in-use est.)
Emission Inventory Summary - Air Toxics and SOx
Percent of Total Inventory

Equipment Category	PM	Aldehydes	Benzene	% total tpy 1,3 But.	Gas. Vap.	SOx
Lawn & Garden	NA	NA	NA	NA	NA	NA
Airport Service	NA	NA	NA	NA	NA	NA
Recreational	NA	NA	NA	NA	NA	NA
Recreational Marine	NA	NA	NA	NA	NA	NA
Light Commercial	NA	NA	NA	NA	NA	NA
Industrial	NA	NA	NA	NA	NA	NA
Construction	NA	NA	NA	NA	NA	NA
Agricultural	NA	NA	NA	NA	NA	NA
Logging	NA	NA	NA	NA	NA	NA
Marine Vessels	NA	NA	NA	NA	NA	NA
Nonroad Engines and Vehicles	NA	NA	NA	NA	NA	NA
Highway Vehicles	NA	NA	NA	NA	NA	NA
Other Area and Point Sources	NA	NA	NA	NA	NA	NA
All Sources	NA	NA	NA	NA	NA	NA

Milwaukee CMSA Inventory A (in-use est.)
Emission Inventory Summary - VOC, NOx, CO

Equipment Category	tpy VOC	tpy NOx	tpy CO	tpsd VOC	tpsd NOx	tpwd CO
Lawn & Garden	2,790	50	22,453	14	0	10
Airport Service	193	1,182	1,715	1	3	5
Recreational	1,525	11	2,575	1	0	21
Recreational Marine	2,632	184	5,453	19	1	0
Light Commercial	1,325	128	16,700	4	0	46
Industrial	787	1,919	11,204	2	5	31
Construction	645	4 166	3,970	3	20	4
Agricultural	366	1,546	1,776	2	8	1
Logging	47	0	136	0	0	0
Marine Vessels	457	398	ND	1	1	ND
Nonroad Engines and Vehicles	10,767	9,585	65,982	47	40	117
Highway Vehicles	ND	33,493	ND	106	101	ND
Other Area and Point Sources	ND	39,621	ND	195	109	ND
All Sources	NA	82,699	NA	348	249	NA

Milwaukee CMSA Inventory A (in-use est.)
Emission Inventory Summary - VOC, NOx, CO
Percent of Total Inventory

Equipment Category	% total tpy VOC	% total tpy NOx	% total tpy CO	% total tpsd VOC	% total tpsd NOx	% total tpwd CO
Lawn & Garden	NA	0.06%	NA	4.04%	0.11%	NA
Airport Service	NA	1.43%	NA	0.15%	1.30%	NA
Recreational	NA	0.01%	NA	0.30%	0.00%	NA
Recreational Marine	NA	0.22%	NA	5.59%	0.57%	NA
Light Commercial	NA	0.15%	NA	1.05%	0.14%	NA
Industrial	NA	2.32%	NA	0.63%	2.11%	NA
Construction	NA	5.04%	NA	0.87%	7.88%	NA
Agricultural	NA	1.87%	NA	0.57%	3.40%	NA
Logging	NA	0.00%	NA	0.04%	0.00%	NA
Marine Vessels	NA	0.48%	NA	0.36%	0.44%	NA
Nonroad Engines and Vehicles	NA	11.59%	NA	13.61%	15.94%	NA
Highway Vehicles	NA	40.50%	NA	30.37%	40.50%	NA
Other Area and Point Sources	NA	47.91%	NA	56.02%	43.56%	NA
All Sources	NA	100.00%	NA	100.00%	100.00%	NA

Milwaukee CMSA Inventory A (in-use est.)
Emission Inventory Summary - Air Toxics and SOx

			tpy			
Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
Lawn & Garden	48	15	76	32	341	14
Airport Service	132	6	6	3	4	78
Recreational	29	3	45	19	28	1
Recreational Marine	133	11	71	31	267	19
Light Commercial	30	9	38	16	107	19
Industrial	153	32	22	10	59	96
Construction	497	77	19	10	19	363
Agricultural	284	47	11	6	9	121
Logging	2	0	1	1	3	0
Marine Vessels	ND	ND	ND	ND	ND	ND
Nonroad Engines and Vehicles	1,310	200	290	127	835	710
Highway Vehicles	ND	ND	ND	ND	ND	ND
Other Area and Point Sources	ND	ND	ND	ND	ND	ND
All Sources	NA	NA	NA	NA	NA	NA

Milwaukee CMSA Inventory A (in-use est.
Emission Inventory Summary - Air Toxics and SOx
Percent of Total Inventory

			% total tpy			
Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
Lawn & Garden	NA	NA	NA	NA	NA	NA
Airport Service	NA	NA	NA	NA	NA	NA
Recreational	NA	NA	NA	NA	NA	NA
Recreational Marine	NA	NA	NA	NA	NA	NA
Light Commercial	NA	NA	NA	NA	NA	NA
Industrial	NA	NA	NA	NA	NA	NA
Construction	NA	NA	NA	NA	NA	NA
Agricultural	NA	NA	NA	NA	NA	NA
Logging	NA	NA	NA	NA	NA	NA
Marine Vessels	NA	NA	NA	NA	NA	NA
Nonroad Engines and Vehicles	NA	NA	NA	NA	NA	NA
Highway Vehicles	NA	NA	NA	NA	NA	NA
Other Area and Point Sources	NA	NA	NA	NA	NA	NA
All Sources	NA	NA	NA	NA	NA	NA

Minneapolis MSA Inventory A (in-use est.)
Emission Inventory Summary - VOC, NOx, CO

	tpy			tpsd		tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	4,377	76	34,257	22	0	15
Airport Service	299	1,825	2,653	1	5	7
Recreational	2,238	16	3,780	2	0	30
Recreational Marine	16,019	460	35,468	121	4	0
Light Commercial	2,431	234	30,644	7	1	84
Industrial	1,228	2,994	17,478	3	8	48
Construction	1,394	9,002	8,579	7	42	9
Agricultural	1,041	4,396	5,049	6	24	3
Logging	87	0	252	0	0	1
Marine Vessels	ND	ND	28	ND	ND	0
Nonroad Engines and Vehicles	29,114	19,005	138,187	168	84	197
Highway Vehicles	ND	ND	419,140	ND	ND	2,422
Other Area and Point Sources	ND	63,307	125,911	ND	173	357
All Sources	NA	NA	683,238	NA	NA	2,976

Minneapolis MSA Inventory A (in-use est.)
Emission Inventory Summary - VOC, NOx, CO
Percent of Total Inventory

	% total tpy			% total tpsd		% total tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	NA	NA	5.01%	NA	NA	0.49%
Airport Service	NA	NA	0.39%	NA	NA	0.24%
Recreational	NA	NA	0.55%	NA	NA	1.02%
Recreational Marine	NA	NA	5.19%	NA	NA	0.00%
Light Commercial	NA	NA	4.49%	NA	NA	2.82%
Industrial	NA	NA	2.56%	NA	NA	1.61%
Construction	NA	NA	1.26%	NA	NA	0.32%
Agricultural	NA	NA	0.74%	NA	NA	0.11%
Logging	NA	NA	0.04%	NA	NA	0.02%
Marine Vessels	NA	NA	0.00%	NA	NA	0.00%
Nonroad Engines and Vehicles	NA	NA	20.23%	NA	NA	6.63%
Highway Vehicles	NA	NA	61.35%	NA	NA	81.38%
Other Area and Point Sources	NA	NA	18.43%	NA	NA	11.99%
All Sources	NA	NA	100.00%	NA	NA	100.00%

Minneapolis MSA Inventory A (in-use est.)
Emission Inventory Summary - Air Toxics and SOx

Equipment Category	PM	Aldehydes	Benzene	tpy 1,3 But.	Gas. Vap.	SOx
Lawn & Garden	74	22	120	50	525	22
Airport Service	205	9	9	4	6	121
Recreational	43	4	66	29	41	2
Recreational Marine	806	68	456	196	933	68
Light Commercial	55	17	70	29	195	34
Industrial	239	51	35	15	92	149
Construction	1,075	166	41	21	41	784
Agricultural	809	133	31	16	25	343
Logging	3	0	3	1	5	0
Marine Vessels	8	ND	ND	ND	ND	ND
Nonroad Engines and Vehicles	3,316	471	829	362	1,863	1,524
Highway Vehicles	42,282	ND	ND	ND	ND	ND
Other Area and Point Sources	214,398	ND	ND	ND	ND	ND
All Sources	259,996	NA	NA	NA	NA	NA

Minneapolis MSA Inventory A (in-use est.)
Emission Inventory Summary - Air Toxics and SOx
Percent of Total Inventory

Equipment Category	PM	Aldehydes	Benzene	% total tpy 1,3 But.	Gas. Vap.	SOx
Lawn & Garden	0.03%	NA	NA	NA	NA	NA
Airport Service	0.08%	NA	NA	NA	NA	NA
Recreational	0.02%	NA	NA	NA	NA	NA
Recreational Marine	0.31%	NA	NA	NA	NA	NA
Light Commercial	0.02%	NA	NA	NA	NA	NA
Industrial	0.09%	NA	NA	NA	NA	NA
Construction	0.41%	NA	NA	NA	NA	NA
Agricultural	0.31%	NA	NA	NA	NA	NA
Logging	0.00%	NA	NA	NA	NA	NA
Marine Vessels	0.00%	NA	NA	NA	NA	NA
Nonroad Engines and Vehicles	1.28%	NA	NA	NA	NA	NA
Highway Vehicles	16.26%	NA	NA	NA	NA	NA
Other Area and Point Sources	82.46%	NA	NA	NA	NA	NA
All Sources	100.00%	NA	NA	NA	NA	NA

New York NECMA Inventory A (in-use est.)
Emission Inventory Summary - VOC, NOx, CO

	tpy			tpsd		tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	28,875	550	243,074	145	3	105
Airport Service	624	3,818	5,539	2	10	15
Recreational	11,280	82	19,054	7	0	155
Recreational Marine	15,919	1,182	48,730	111	9	5
Light Commercial	20,831	2,008	262,706	57	6	720
Industrial	7,171	17,507	102,092	20	48	280
Construction	8,735	56,417	53,779	41	266	59
Agricultural	649	2,745	3,150	4	15	2
Logging	364	1	1,051	1	0	3
Marine Vessels	789	12,991	2,458	2	36	7
Nonroad Engines and Vehicles	95,237	97,300	741,633	390	392	1,351
Highway Vehicles	ND	317,257	3,129,400	1,114	956	7,373
Other Area and Point Sources	ND	232,882	546,500	1,578	638	804
All Sources	NA	647,439	4,417,533	3,082	1,986	9,528

New York NECMA Inventory A (in-use est.)
Emission Inventory Summary - VOC, NOx, CO
Percent of Total Inventory

	% total tpy			% total tpsd		% total tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	NA	0.08%	5.50%	4.70%	0.15%	1.10%
Airport Service	NA	0.59%	0.13%	0.06%	0.53%	0.16%
Recreational	NA	0.01%	0.43%	0.24%	0.00%	1.63%
Recreational Marine	NA	0.18%	1.10%	3.59%	0.44%	0.06%
Light Commercial	NA	0.31%	5.95%	1.87%	0.28%	7.55%
Industrial	NA	2.70%	2.31%	0.65%	2.41%	2.94%
Construction	NA	8.71%	1.22%	1.33%	13.38%	0.62%
Agricultural	NA	0.42%	0.07%	0.12%	0.76%	0.02%
Logging	NA	0.00%	0.02%	0.03%	0.00%	0.03%
Marine Vessels	NA	2.01%	0.06%	0.07%	1.79%	0.07%
Nonroad Engines and Vehicles	NA	15.03%	16.79%	12.65%	19.75%	14.18%
Highway Vehicles	NA	49.00%	70.84%	36.15%	48.13%	77.38%
Other Area and Point Sources	NA	35.97%	12.37%	51.20%	32.12%	8.44%
All Sources	NA	100.00%	100.00%	100.00%	100.00%	100.00%

New York NECMA Inventory A (in-use est.)
Emission Inventory Summary - Air Toxics and SOx

Equipment Category	PM	Aldehydes	Benzene	tpy 1,3 But.	Gas. Vap.	SOx
Lawn & Garden	518	156	787	329	3,547	156
Airport Service	428	19	19	9	12	252
Recreational	217	22	334	144	201	8
Recreational Marine	644	95	397	171	2,803	107
Light Commercial	473	142	599	250	1,664	295
Industrial	1,399	296	204	90	528	874
Construction	6,731	1,041	257	131	254	4,912
Agricultural	505	83	19	10	15	214
Logging	14	2	11	4	20	0
Marine Vessels	620	ND	ND	ND	ND	4,240
Nonroad Engines and Vehicles	11,548	1,856	2,627	1,139	9,044	11,059
Highway Vehicles	232,769	ND	ND	ND	ND	ND
Other Area and Point Sources	119,873	ND	ND	ND	ND	ND
All Sources	364,190	NA	NA	NA	NA	NA

New York NECMA Inventory A (in-use est.)
Emission Inventory Summary - Air Toxics and SOx
Percent of Total Inventory

Equipment Category	PM	Aldehydes	Benzene	% total tpy 1,3 But.	Gas. Vap.	SOx
Lawn & Garden	0.14%	NA	NA	NA	NA	NA
Airport Service	0.12%	NA	NA	NA	NA	NA
Recreational	0.06%	NA	NA	NA	NA	NA
Recreational Marine	0.18%	NA	NA	NA	NA	NA
Light Commercial	0.13%	NA	NA	NA	NA	NA
Industrial	0.38%	NA	NA	NA	NA	NA
Construction	1.85%	NA	NA	NA	NA	NA
Agricultural	0.14%	NA	NA	NA	NA	NA
Logging	0.00%	NA	NA	NA	NA	NA
Marine Vessels	0.17%	NA	NA	NA	NA	NA
Nonroad Engines and Vehicles	3.17%	NA	NA	NA	NA	NA
Highway Vehicles	63.91%	NA	NA	NA	NA	NA
Other Area and Point Sources	32.91%	NA	NA	NA	NA	NA
All Sources	100.00%	NA	NA	NA	NA	NA

Philedelphia MSA Inventory A (in-use est.)
Emission Inventory Summary - VOC, NOx, CO

Equipment Category	tpy VOC	tpy NOx	tpy CO	tpsd VOC	tpsd NOx	tpwd CO
Lawn & Garden	18,553	327	158,071	75	1	94
Airport Service	317	1,936	2,812	1	5	8
Recreational	2,826	20	5,347	3	0	36
Recreational Marine	11,059	967	36,981	67	6	8
Light Commercial	5,147	544	68,064	14	1	186
Industrial	2,301	5,553	32,517	6	15	89
Construction	3,205	20,460	19,932	13	85	33
Agricultural	895	3,820	4,380	4	17	3
Logging	239	1	689	1	0	2
Marine Vessels	494	9,181	1,377	1	25	4
Nonroad Engines and Vehicles	45,036	42,809	330,169	185	157	463
Highway Vehicles	ND	123,720	568,888	432	373	ND
Other Area and Point Sources	ND	137,579	178,772	911	377	ND
All Sources	NA	304,108	1,077,829	1,528	906	NA

Philedelphia MSA Inventory A (in-use est.)
Emission Inventory Summary - VOC, NOx, CO
Percent of Total Inventory

Equipment Category	% total tpy VOC	% total tpy NOx	% total tpy CO	% total tpsd VOC	% total tpsd NOx	% total tpwd CO
Lawn & Garden	NA	0.11%	14.67%	4.89%	0.16%	NA
Airport Service	NA	0.64%	0.26%	0.06%	0.59%	NA
Recreational	NA	0.01%	0.50%	0.20%	0.00%	NA
Recreational Marine	NA	0.32%	3.43%	4.37%	0.67%	NA
Light Commercial	NA	0.18%	6.31%	0.93%	0.16%	NA
Industrial	NA	1.83%	3.02%	0.42%	1.68%	NA
Construction	NA	6.73%	1.85%	0.87%	9.40%	NA
Agricultural	NA	1.26%	0.41%	0.26%	1.85%	NA
Logging	NA	0.00%	0.06%	0.04%	0.00%	NA
Marine Vessels	NA	3.02%	0.13%	0.09%	2.78%	NA
Nonroad Engines and Vehicles	NA	14.08%	30.63%	12.13%	17.28%	NA
Highway Vehicles	NA	40.68%	52.78%	28.24%	41.14%	NA
Other Area and Point Sources	NA	45.24%	16.59%	59.63%	41.59%	NA
All Sources	NA	100.00%	100.00%	100.00%	100.00%	NA

Philadelphia MSA Inventory A (in-use est.)
Emission Inventory Summary - Air Toxics and SOx

Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
	tpy					
Lawn & Garden	341	102	518	217	1,890	98
Airport Service	217	10	9	5	6	128
Recreational	52	6	83	36	67	2
Recreational Marine	473	72	292	126	1,412	85
Light Commercial	120	36	148	61	441	79
Industrial	445	94	66	29	165	278
Construction	2,424	376	94	48	91	1,783
Agricultural	703	115	26	14	18	298
Logging	9	1	7	3	13	0
Marine Vessels	553	ND	ND	ND	ND	4,366
Nonroad Engines and Vehicles	5,337	813	1,244	538	4,104	7,118
Highway Vehicles	ND	ND	ND	ND	ND	ND
Other Area and Point Sources	ND	ND	ND	ND	ND	ND
All Sources	NA	NA	NA	NA	NA	NA

Philadelphia MSA Inventory A (in-use est.)
Emission Inventory Summary - Air Toxics and SOx
Percent of Total Inventory

Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
	% total tpy					
Lawn & Garden	NA	NA	NA	NA	NA	NA
Airport Service	NA	NA	NA	NA	NA	NA
Recreational	NA	NA	NA	NA	NA	NA
Recreational Marine	NA	NA	NA	NA	NA	NA
Light Commercial	NA	NA	NA	NA	NA	NA
Industrial	NA	NA	NA	NA	NA	NA
Construction	NA	NA	NA	NA	NA	NA
Agricultural	NA	NA	NA	NA	NA	NA
Logging	NA	NA	NA	NA	NA	NA
Marine Vessels	NA	NA	NA	NA	NA	NA
Nonroad Engines and Vehicles	NA	NA	NA	NA	NA	NA
Highway Vehicles	NA	NA	NA	NA	NA	NA
Other Area and Point Sources	NA	NA	NA	NA	NA	NA
All Sources	NA	NA	NA	NA	NA	NA

Provo-Orem MSA Inventory A (in-use est.)
Emission Inventory Summary - VOC, NOx, CO

Equipment Category	tpy VOC	tpy NOx	tpy CO	tpsd VOC	tpsd NOx	tpwd CO
Lawn & Garden	1,015	19	8,900	5	0	3
Airport Service	0	0	0	0	0	0
Recreational	803	6	1,424	1	0	11
Recreational Marine	67	8	209	0	0	0
Light Commercial	134	14	1,775	0	0	5
Industrial	63	152	892	0	0	2
Construction	95	611	593	0	3	1
Agricultural	107	461	515	1	3	0
Logging	10	0	30	0	0	0
Marine Vessels	ND	ND	315	ND	ND	1
Nonroad Engines and Vehicles	2,295	1,271	14,652	8	6	22
Highway Vehicles	ND	ND	73,804	ND	ND	440
Other Area and Point Sources	ND	ND	38,273	ND	ND	38
All Sources	NA	NA	126,729	NA	NA	501

Provo-Orem MSA Inventory A (in-use est.)
Emission Inventory Summary - VOC, NOx, CO
Percent of Total Inventory

Equipment Category	% total tpy VOC	% total tpy NOx	% total tpy CO	% total tpsd VOC	% total tpsd NOx	% total tpwd CO
Lawn & Garden	NA	NA	7.02%	NA	NA	0.52%
Airport Service	NA	NA	0.00%	NA	NA	0.00%
Recreational	NA	NA	1.12%	NA	NA	2.10%
Recreational Marine	NA	NA	0.17%	NA	NA	0.00%
Light Commercial	NA	NA	1.40%	NA	NA	0.97%
Industrial	NA	NA	0.70%	NA	NA	0.49%
Construction	NA	NA	0.47%	NA	NA	0.13%
Agricultural	NA	NA	0.41%	NA	NA	0.07%
Logging	NA	NA	0.02%	NA	NA	0.02%
Marine Vessels	NA	NA	0.25%	NA	NA	0.17%
Nonroad Engines and Vehicles	NA	NA	11.56%	NA	NA	4.46%
Highway Vehicles	NA	NA	58.24%	NA	NA	87.88%
Other Area and Point Sources	NA	NA	30.20%	NA	NA	7.66%
All Sources	NA	NA	100.00%	NA	NA	100.00%

Provo-Orem MSA Inventory A (in-use est.)
Emission Inventory Summary - Air Toxics and SOx

Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
	tpy					
Lawn & Garden	19	6	28	12	115	6
Airport Service	0	0	0	0	0	0
Recreational	15	2	24	10	16	1
Recreational Marine	2	0	1	1	20	1
Light Commercial	3	1	4	2	12	2
Industrial	12	3	2	1	5	8
Construction	72	11	3	1	3	53
Agricultural	85	14	3	2	2	36
Logging	0	0	0	0	1	0
Marine Vessels	ND	ND	ND	ND	ND	ND
Nonroad Engines and Vehicles	209	36	65	28	172	106
Highway Vehicles	3,668	ND	ND	ND	ND	ND
Other Area and Point Sources	45,615	ND	ND	ND	ND	ND
All Sources	49,492	NA	NA	NA	NA	NA

Provo-Orem MSA Inventory A (in-use est.)
Emission Inventory Summary - Air Toxics and SOx
Percent of Total Inventory

Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
	% total tpy					
Lawn & Garden	0.04%	NA	NA	NA	NA	NA
Airport Service	0.00%	NA	NA	NA	NA	NA
Recreational	0.03%	NA	NA	NA	NA	NA
Recreational Marine	0.00%	NA	NA	NA	NA	NA
Light Commercial	0.01%	NA	NA	NA	NA	NA
Industrial	0.02%	NA	NA	NA	NA	NA
Construction	0.15%	NA	NA	NA	NA	NA
Agricultural	0.17%	NA	NA	NA	NA	NA
Logging	0.00%	NA	NA	NA	NA	NA
Marine Vessels	0.00%	NA	NA	NA	NA	NA
Nonroad Engines and Vehicles	0.42%	NA	NA	NA	NA	NA
Highway Vehicles	7.41%	NA	NA	NA	NA	NA
Other Area and Point Sources	92.17%	NA	NA	NA	NA	NA
All Sources	100.00%	NA	NA	NA	NA	NA

Saint Louis MSA Inventory A (in-use est.)
Emission Inventory Summary - VOC, NOx, CO

Equipment Category	tpy			tpsd		tpwd
	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	5,001	87	38,932	25	0	16
Airport Service	216	1,321	1,921	1	4	5
Recreational	1,999	14	3,377	1	0	27
Recreational Marine	5,458	271	14,345	40	2	0
Light Commercial	2,149	207	27,086	6	1	74
Industrial	1,183	2,882	16,825	3	8	46
Construction	1,501	9,691	9,235	7	46	10
Agricultural	861	3,635	4,175	5	20	3
Logging	102	0	295	0	0	1
Marine Vessels	2,488	1,820	ND	7	5	ND
Nonroad Engines and Vehicles	20,957	19,929	116,191	96	85	183
Highway Vehicles	ND	62,039	ND	208	187	1,710
Other Area and Point Sources	ND	158,510	ND	360	434	441
All Sources	NA	240,478	NA	663	706	2.333

Saint Louis MSA Inventory A (in-use est.)
Emission Inventory Summary - VOC, NOx, CO
Percent of Total Inventory

Equipment Category	% total tpy			% total tpsd		% total tpwd
	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	NA	0.04%	NA	3.81%	0.07%	0.71%
Airport Service	NA	0.55%	NA	0.09%	0.51%	0.23%
Recreational	NA	0.01%	NA	0.21%	0.00%	1.16%
Recreational Marine	NA	0.11%	NA	6.05%	0.30%	0.00%
Light Commercial	NA	0.09%	NA	0.89%	0.08%	3.18%
Industrial	NA	1.20%	NA	0.50%	1.12%	1.98%
Construction	NA	4.03%	NA	1.07%	6.46%	0.43%
Agricultural	NA	1.51%	NA	0.71%	2.82%	0.12%
Logging	NA	0.00%	NA	0.04%	0.00%	0.03%
Marine Vessels	NA	0.76%	NA	1.03%	0.71%	0.00%
Nonroad Engines and Vehicles	NA	8.29%	NA	14.40%	12.06%	7.83%
Highway Vehicles	NA	25.80%	NA	31.32%	26.47%	73.26%
Other Area and Point Sources	NA	65.91%	NA	54.28%	61.47%	18.90%
All Sources	NA	100.00%	NA	100.00%	100.00%	100.00%

Saint Louis MSA Inventory A (in-use est.)
Emission Inventory Summary - Air Toxics and SOx

Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
	tpy					
Lawn & Garden	84	26	137	57	598	25
Airport Service	148	7	6	3	4	87
Recreational	39	4	59	26	36	1
Recreational Marine	249	28	146	63	619	29
Light Commercial	49	15	62	26	173	30
Industrial	230	49	34	15	89	144
Construction	1,157	179	44	23	44	844
Agricultural	668	110	25	13	21	284
Logging	4	0	3	1	6	0
Marine Vessels	184	ND	ND	ND	ND	ND
Nonroad Engines and Vehicles	2,811	416	516	226	1,589	1,445
Highway Vehicles	38,099	ND	ND	ND	ND	ND
Other Area and Point Sources	89,636	ND	ND	ND	ND	ND
All Sources	130,546	NA	NA	NA	NA	NA

Saint Louis MSA Inventory A (in-use est.)
Emission Inventory Summary - Air Toxics and SOx
Percent of Total Inventory

Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
	% total tpy					
Lawn & Garden	0.06%	NA	NA	NA	NA	NA
Airport Service	0.11%	NA	NA	NA	NA	NA
Recreational	0.03%	NA	NA	NA	NA	NA
Recreational Marine	0.19%	NA	NA	NA	NA	NA
Light Commercial	0.04%	NA	NA	NA	NA	NA
Industrial	0.18%	NA	NA	NA	NA	NA
Construction	0.89%	NA	NA	NA	NA	NA
Agricultural	0.51%	NA	NA	NA	NA	NA
Logging	0.00%	NA	NA	NA	NA	NA
Marine Vessels	0.14%	NA	NA	NA	NA	NA
Nonroad Engines and Vehicles	2.15%	NA	NA	NA	NA	NA
Highway Vehicles	29.18%	NA	NA	NA	NA	NA
Other Area and Point Sources	68.66%	NA	NA	NA	NA	NA
All Sources	100.00%	NA	NA	NA	NA	NA

San Diego AB Inventory A (in-use est.)
Emission Inventory Summary - VOC, NOx, CO

Equipment Category	tpy VOC	tpy NOx	tpy CO	tpsd VOC	tpsd NOx	tpwd CO
Lawn & Garden	12,712	222	111,081	46	1	78
Airport Service	235	1,439	2,092	1	4	6
Recreational	2,234	15	7,883	9	0	11
Recreational Marine	4,437	593	19,056	23	3	15
Light Commercial	1,657	199	23,281	5	1	64
Industrial	712	1,704	9,999	2	5	27
Construction	2,286	14,354	14,381	8	52	32
Agricultural	280	1,215	1,367	1	5	1
Logging	118	0	342	0	0	1
Marine Vessels	ND	ND	ND	3	41	7
Nonroad Engines and Vehicles	24,671	19,741	189,481	98	111	241
Highway Vehicles	ND	47,136	570,100	130	142	1,343
Other Area and Point Sources	ND	ND	94,000	271	34	154
All Sources	NA	NA	853,581	498	287	1,738

San Diego AB Inventory A (in-use est.)
Emission Inventory Summary - VOC, NOx, CO
Percent of Total Inventory

Equipment Category	% total tpy VOC	% total tpy NOx	% total tpy CO	% total tpsd VOC	% total tpsd NOx	% total tpwd CO
Lawn & Garden	NA	NA	13.01%	9.32%	0.29%	4.49%
Airport Service	NA	NA	0.25%	0.13%	1.37%	0.33%
Recreational	NA	NA	0.92%	1.82%	0.02%	0.65%
ecreational Marine	NA	NA	2.23%	4.57%	1.09%	0.84%
ght Commercial	NA	NA	2.73%	0.92%	0.19%	3.67%
dustrial	NA	NA	1.17%	0.40%	1.63%	1.58%
onstruction	NA	NA	1.68%	1.66%	18.10%	1.81%
gricultural	NA	NA	0.16%	0.21%	1.58%	0.05%
ogging	NA	NA	0.04%	0.07%	0.00%	0.05%
larine Vessels	NA	NA	0.00%	0.50%	14.33%	0.39%
Nonroad Engines and Vehicles	NA	NA	22.20%	19.60%	38.59%	13.86%
Highway Vehicles	NA	NA	66.79%	26.03%	49.52%	77.30%
Other Area and Point Sources	NA	NA	11.01%	54.38%	11.89%	8.84%
All Sources	NA	NA	100.00%	100.00%	100.00%	100.00%

San Diego AB Inventory A (in-use est.)
Emission Inventory Summary - Air Toxics and SOx

				tpy		
Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
Lawn & Garden	246	72	359	150	1,166	68
Airport Service	161	7	7	3	4	95
Recreational	22	7	65	27	134	3
Recreational Marine	167	38	113	48	725	46
Light Commercial	41	12	47	20	151	29
Industrial	137	29	20	9	49	86
Construction	1,700	265	67	34	64	1,252
Agricultural	224	37	8	4	5	95
Logging	5	1	3	1	6	0
Marine Vessels	854	ND	ND	ND	ND	6,979
Nonroad Engines and Vehicles	3,557	467	691	298	2,305	8,652
Highway Vehicles	6,935	ND	ND	ND	ND	2,409
Other Area and Point Sources	179,215	ND	ND	ND	ND	3,723
All Sources	189,707	NA	NA	NA	NA	14,784

San Diego AB Inventory A (in-use est.)
Emission Inventory Summary - Air Toxics and SOx
Percent of Total Inventory

				% total tpy		
Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
Lawn & Garden	0.13%	NA	NA	NA	NA	0.46%
Airport Service	0.09%	NA	NA	NA	NA	0.64%
Recreational	0.01%	NA	NA	NA	NA	0.02%
Recreational Marine	0.09%	NA	NA	NA	NA	0.31%
Light Commercial	0.02%	NA	NA	NA	NA	0.19%
Industrial	0.07%	NA	NA	NA	NA	0.58%
Construction	0.90%	NA	NA	NA	NA	8.47%
Agricultural	0.12%	NA	NA	NA	NA	0.64%
Logging	0.00%	NA	NA	NA	NA	0.00%
Marine Vessels	0.45%	NA	NA	NA	NA	47.20%
Nonroad Engines and Vehicles	1.87%	NA	NA	NA	NA	58.52%
Highway Vehicles	3.66%	NA	NA	NA	NA	16.29%
Other Area and Point Sources	94.47%	NA	NA	NA	NA	25.18%
All Sources	100.00%	NA	NA	NA	NA	100.00%

San Joaquin AB Inventory A (in-use est.)
Emission Inventory Summary - VOC, NOx, CO

	tpy			tpsd		tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	8,897	128	66,112	31	0	53
Airport Service	27	163	241	0	0	1
Recreational	455	3	1,606	2	0	2
Recreational Marine	1,090	254	5,622	5	1	4
Light Commercial	1,745	210	24,511	5	1	67
Industrial	580	1,387	8,140	2	4	22
Construction	1,797	11,280	11,302	7	41	25
Agricultural	3,846	16,697	18,786	14	62	12
Logging	257	145	928	1	0	3
Marine Vessels	ND	ND	ND	0	3	0
Nonroad Engines and Vehicles	18,693	30,266	137,247	67	113	190
Highway Vehicles	ND	ND	ND	150	240	1,100
Other Area and Point Sources	ND	ND	ND	1,022	249	683
All Sources	NA	NA	NA	1,239	601	1,973

San Joaquin AB Inventory A (in-use est.)
Emission Inventory Summary - VOC, NOx, CO
Percent of Total Inventory

	% total tpy			% total tpsd		% total tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	NA	NA	NA	2.50%	0.08%	2.71%
Airport Service	NA	NA	NA	0.01%	0.07%	0.03%
Recreational	NA	NA	NA	0.17%	0.00%	0.12%
Recreational Marine	NA	NA	NA	0.44%	0.22%	0.22%
Light Commercial	NA	NA	NA	0.39%	0.10%	3.40%
Industrial	NA	NA	NA	0.13%	0.63%	1.13%
Construction	NA	NA	NA	0.53%	6.78%	1.26%
Agricultural	NA	NA	NA	1.16%	10.34%	0.63%
Logging	NA	NA	NA	0.06%	0.07%	0.13%
Marine Vessels	NA	NA	NA	0.02%	0.44%	0.02%
Nonroad Engines and Vehicles	NA	NA	NA	5.39%	18.74%	9.64%
Highway Vehicles	NA	NA	NA	12.11%	39.91%	55.74%
Other Area and Point Sources	NA	NA	NA	82.50%	41.35%	34.62%
All Sources	NA	NA	NA	100.00%	100.00%	100.00%

San Joaquin AB Inventory A (in-use est.)
Emission Inventory Summary - Air Toxics and SOx

				tpy		
Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
Lawn & Garden	148	45	253	106	761	40
Airport Service	18	1	1	0	0	11
Recreational	5	1	13	6	27	1
Recreational Marine	29	11	22	9	369	18
Light Commercial	43	13	50	21	159	30
Industrial	112	24	17	7	40	70
Construction	1,336	208	53	27	50	984
Agricultural	3,075	504	114	59	66	1,304
Logging	28	4	8	3	14	12
Marine Vessels	62	ND	ND	ND	ND	402
Nonroad Engines and Vehicles	4,855	810	530	238	1,488	2,870
Highway Vehicles	13,505	ND	ND	ND	ND	9,125
Other Area and Point Sources	731,789	ND	ND	ND	ND	16,790
All Sources	750,149	NA	NA	NA	NA	28,785

San Joaquin AB Inventory A (in-use est.)
Emission Inventory Summary - Air Toxics and SOx
Percent of Total Inventory

				% total tpy		
Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
Lawn & Garden	0.02%	NA	NA	NA	NA	0.14%
Airport Service	0.00%	NA	NA	NA	NA	0.04%
Recreational	0.00%	NA	NA	NA	NA	0.00%
Recreational Marine	0.00%	NA	NA	NA	NA	0.06%
Light Commercial	0.01%	NA	NA	NA	NA	0.10%
Industrial	0.01%	NA	NA	NA	NA	0.24%
Construction	0.18%	NA	NA	NA	NA	3.42%
Agricultural	0.41%	NA	NA	NA	NA	4.53%
Logging	0.00%	NA	NA	NA	NA	0.04%
Marine Vessels	0.01%	NA	NA	NA	NA	1.39%
Nonroad Engines and Vehicles	0.65%	NA	NA	NA	NA	9.97%
Highway Vehicles	1.80%	NA	NA	NA	NA	31.70%
Other Area and Point Sources	97.55%	NA	NA	NA	NA	58.33%
All Sources	100.00%	NA	NA	NA	NA	100.00%

Seattle-Tacoma MSA Inventory A (in-use est.)
Emission Inventory Summary - VOC, NOx, CO

	tpy			tpsd		tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	9,149	154	75,041	37	1	36
Airport Service	212	1,295	1,885	1	4	5
Recreational	1,591	11	4,767	6	0	12
Recreational Marine	6,450	723	21,814	37	5	12
Light Commercial	1,923	224	26,721	5	1	73
Industrial	803	1,915	11,246	2	5	31
Construction	2,025	12,932	12,749	8	54	21
Agricultural	282	1,231	1,349	1	5	1
Logging	390	1,507	3,112	1	4	9
Marine Vessels	2,194	17,253	31,940	6	47	88
Nonroad Engines and Vehicles	25,018	37,245	190,624	105	125	287
Highway Vehicles	ND	ND	267,670	ND	ND	1,515
Other Area and Point Sources	ND	ND	199,979	ND	ND	565
All Sources	NA	NA	658,273	NA	NA	2,367

Seattle-Tacoma MSA Inventory A (in-use est.)
Emission Inventory Summary - VOC, NOx, CO
Percent of Total Inventory

	% total tpy			% total tpsd		% total tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	NA	NA	11.40%	NA	NA	1.51%
Airport Service	NA	NA	0.29%	NA	NA	0.22%
Recreational	NA	NA	0.72%	NA	NA	0.52%
Recreational Marine	NA	NA	3.31%	NA	NA	0.51%
Light Commercial	NA	NA	4.06%	NA	NA	3.09%
Industrial	NA	NA	1.71%	NA	NA	1.30%
Construction	NA	NA	1.94%	NA	NA	0.89%
Agricultural	NA	NA	0.20%	NA	NA	0.04%
Logging	NA	NA	0.47%	NA	NA	0.36%
Marine Vessels	NA	NA	4.85%	NA	NA	3.70%
Nonroad Engines and Vehicles	NA	NA	28.96%	NA	NA	12.13%
Highway Vehicles	NA	NA	40.66%	NA	NA	64.00%
Other Area and Point Sources	NA	NA	30.38%	NA	NA	23.87%
All Sources	NA	NA	100.00%	NA	NA	100.00%

Seattle-Tacoma MSA Inventory A (in-use est.)
Emission Inventory Summary - Air Toxics and SOx

Equipment Category	PM	Aldehydes	Benzene	tpy 1,3 But.	Gas. Vap.	SOx
Lawn & Garden	153	48	257	107	891	46
Airport Service	145	7	6	3	4	86
Recreational	21	4	46	20	79	2
Recreational Marine	233	43	147	63	1,589	58
Light Commercial	47	14	55	23	178	32
Industrial	154	33	23	10	57	96
Construction	1,525	237	60	30	57	1,128
Agricultural	226	37	8	4	5	96
Logging	200	29	11	5	26	125
Marine Vessels	1,017	ND	ND	ND	ND	7,576
Nonroad Engines and Vehicles	3,721	452	614	266	2,887	9,245
Highway Vehicles	30,151	ND	ND	ND	ND	ND
Other Area and Point Sources	37,878	ND	ND	ND	ND	ND
All Sources	71,750	NA	NA	NA	NA	NA

Seattle-Tacoma MSA Inventory A (in-use est.)
Emission Inventory Summary - Air Toxics and SOx
Percent of Total Inventory

Equipment Category	PM	Aldehydes	Benzene	% total tpy 1,3 But.	Gas. Vap.	SOx
Lawn & Garden	0.21%	NA	NA	NA	NA	NA
Airport Service	0.20%	NA	NA	NA	NA	NA
Recreational	0.03%	NA	NA	NA	NA	NA
Recreational Marine	0.32%	NA	NA	NA	NA	NA
Light Commercial	0.07%	NA	NA	NA	NA	NA
Industrial	0.21%	NA	NA	NA	NA	NA
Construction	2.13%	NA	NA	NA	NA	NA
Agricultural	0.32%	NA	NA	NA	NA	NA
Logging	0.28%	NA	NA	NA	NA	NA
Marine Vessels	1.42%	NA	NA	NA	NA	NA
Nonroad Engines and Vehicles	5.19%	NA	NA	NA	NA	NA
Highway Vehicles	42.02%	NA	NA	NA	NA	NA
Other Area and Point Sources	52.79%	NA	NA	NA	NA	NA
All Sources	100.00%	NA	NA	NA	NA	NA

South Coast AB Inventory A (in-use est.)
Emission Inventory Summary - VOC, NOx, CO

Equipment Category	tpy VOC	tpy NOx	tpy CO	tpsd VOC	tpsd NOx	tpwd CO
Lawn & Garden	62,428	1,107	552,244	229	4	384
Airport Service	890	5,447	7,911	2	15	22
Recreational	8,066	53	28,465	33	0	41
Recreational Marine	19,534	2,668	84,583	100	14	65
Light Commercial	13,340	1,605	187,411	37	4	513
Industrial	7,068	16,917	99,269	20	46	272
Construction	10,905	68,455	68,586	39	248	150
Agricultural	636	2,759	3,104	2	10	2
Logging	500	75	1,540	1	0	4
Marine Vessels	ND	ND	ND	7	68	10
Nonroad Engines and Vehicles	123,365	99,086	1,033,114	472	410	1,463
Highway Vehicles	ND	ND	ND	650	660	9,732
Other Area and Point Sources	ND	ND	ND	1,400	334	265
All Sources	NA	NA	NA	2,522	1,404	11,460

South Coast AB Inventory A (in-use est.)
Emission Inventory Summary - VOC, NOx, CO
Percent of Total Inventory

Equipment Category	% total tpy VOC	% total tpy NOx	% total tpy CO	% total tpsd VOC	% total tpsd NOx	% total tpwd CO
Lawn & Garden	NA	NA	NA	9.08%	0.29%	3.35%
Airport Service	NA	NA	NA	0.10%	1.06%	0.19%
Recreational	NA	NA	NA	1.30%	0.02%	0.35%
Recreational Marine	NA	NA	NA	3.97%	1.00%	0.57%
Light Commercial	NA	NA	NA	1.46%	0.31%	4.48%
Industrial	NA	NA	NA	0.78%	3.30%	2.37%
Construction	NA	NA	NA	1.57%	17.63%	1.31%
Agricultural	NA	NA	NA	0.09%	0.73%	0.02%
Logging	NA	NA	NA	0.05%	0.01%	0.04%
Marine Vessels	NA	NA	NA	0.29%	4.87%	0.09%
Nonroad Engines and Vehicles	NA	NA	NA	18.70%	29.23%	12.77%
Highway Vehicles	NA	NA	NA	25.78%	47.00%	84.92%
Other Area and Point Sources	NA	NA	NA	55.52%	23.77%	2.31%
All Sources	NA	NA	NA	100.00%	100.00%	100.00%

South Coast AB Inventory A (in-use est.)
Emission Inventory Summary - Air Toxics and SOx

Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
	tpy					
Lawn & Garden	1,224	356	1,764	737	5,756	339
Airport Service	610	28	26	13	16	360
Recreational	80	25	233	99	484	10
Recreational Marine	730	167	494	212	3,262	206
Light Commercial	329	96	382	158	1,218	230
Industrial	1,362	288	202	90	486	849
Construction	8,106	1,265	322	163	306	5,972
Agricultural	508	83	19	10	11	215
Logging	28	4	15	6	27	7
Marine Vessels	1,515	ND	ND	ND	ND	12,797
Nonroad Engines and Vehicles	14,493	2,310	3,456	1,487	11,567	20,985
Highway Vehicles	34,675	ND	ND	ND	ND	11,680
Other Area and Point Sources	766,500	ND	ND	ND	ND	18,214
All Sources	815,668	NA	NA	NA	NA	50,879

South Coast AB Inventory A (in-use est.)
Emission Inventory Summary - Air Toxics and SOx
Percent of Total Inventory

Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
	% total tpy					
Lawn & Garden	0.15%	NA	NA	NA	NA	0.67%
Airport Service	0.07%	NA	NA	NA	NA	0.71%
Recreational	0.01%	NA	NA	NA	NA	0.02%
Recreational Marine	0.09%	NA	NA	NA	NA	0.41%
Light Commercial	0.04%	NA	NA	NA	NA	0.45%
Industrial	0.17%	NA	NA	NA	NA	1.67%
Construction	0.99%	NA	NA	NA	NA	11.74%
Agricultural	0.06%	NA	NA	NA	NA	0.42%
Logging	0.00%	NA	NA	NA	NA	0.01%
Marine Vessels	0.19%	NA	NA	NA	NA	25.15%
Nonroad Engines and Vehicles	1.78%	NA	NA	NA	NA	41.25%
Highway Vehicles	4.25%	NA	NA	NA	NA	22.96%
Other Area and Point Sources	93.97%	NA	NA	NA	NA	35.80%
All Sources	100.00%	NA	NA	NA	NA	100.00%

Springfield MSA Inventory A (in-use est.)
Emission Inventory Summary - VOC, NOx, CO

	tpy			tpsd		tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	1,162	20	9,089	6	0	4
Airport Service	0	0	0	0	0	0
Recreational	1,080	8	1,825	1	0	15
Recreational Marine	738	70	2,720	5	1	0
Light Commercial	503	49	6,350	1	0	17
Industrial	259	633	3,691	1	2	10
Construction	217	1,401	1,336	1	7	1
Agricultural	82	345	396	0	2	0
Logging	24	0	70	0	0	0
Marine Vessels	0	0	0	0	0	ND
Nonroad Engines and Vehicles	4,066	2,526	25,475	15	11	49
Highway Vehicles	ND	ND	ND	62	30	ND
Other Area and Point Sources	ND	ND	ND	50	30	ND
All Sources	NA	NA	NA	127	71	NA

Springfield MSA Inventory A (in-use est.)
Emission Inventory Summary - VOC, NOx, CO
Percent of Total Inventory

	% total tpy			% total tpsd		% total tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	NA	NA	NA	4.61%	0.15%	NA
Airport Service	NA	NA	NA	0.00%	0.00%	NA
Recreational	NA	NA	NA	0.59%	0.01%	NA
Recreational Marine	NA	NA	NA	3.97%	0.74%	NA
Light Commercial	NA	NA	NA	1.09%	0.19%	NA
Industrial	NA	NA	NA	0.57%	2.43%	NA
Construction	NA	NA	NA	0.80%	9.26%	NA
Agricultural	NA	NA	NA	0.35%	2.65%	NA
Logging	NA	NA	NA	0.05%	0.00%	NA
Marine Vessels	NA	NA	NA	0.00%	0.00%	NA
Nonroad Engines and Vehicles	NA	NA	NA	12.03%	15.43%	NA
Highway Vehicles	NA	NA	NA	49.01%	42.50%	NA
Other Area and Point Sources	NA	NA	NA	38.96%	42.07%	NA
All Sources	NA	NA	NA	100.00%	100.00%	NA

Springfield MSA Inventory A (in-use est.)
Emission Inventory Summary - Air Toxics and SOx

Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
	tpy					
Lawn & Garden	19	6	32	13	136	6
Airport Service	0	0	0	0	0	0
Recreational	21	2	32	14	19	1
Recreational Marine	27	5	18	8	155	6
Light Commercial	11	3	14	6	40	7
Industrial	51	11	7	3	19	32
Construction	167	26	6	3	6	122
Agricultural	63	10	2	1	2	27
Logging	1	0	1	0	1	0
Marine Vessels	0	0	ND	ND	ND	0
Nonroad Engines and Vehicles	360	64	113	49	380	200
Highway Vehicles	ND	ND	ND	ND	ND	ND
Other Area and Point Sources	ND	ND	ND	ND	ND	ND
All Sources	NA	NA	NA	NA	NA	NA

Springfield MSA Inventory A (in-use est.)
Emission Inventory Summary - Air Toxics and SOx
Percent of Total Inventory

Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
	% total tpy					
Lawn & Garden	NA	NA	NA	NA	NA	NA
Airport Service	NA	NA	NA	NA	NA	NA
Recreational	NA	NA	NA	NA	NA	NA
Recreational Marine	NA	NA	NA	NA	NA	NA
Light Commercial	NA	NA	NA	NA	NA	NA
Industrial	NA	NA	NA	NA	NA	NA
Construction	NA	NA	NA	NA	NA	NA
Agricultural	NA	NA	NA	NA	NA	NA
Logging	NA	NA	NA	NA	NA	NA
Marine Vessels	NA	NA	NA	NA	NA	NA
Nonroad Engines and Vehicles	NA	NA	NA	NA	NA	NA
Highway Vehicles	NA	NA	NA	NA	NA	NA
Other Area and Point Sources	NA	NA	NA	NA	NA	NA
All Sources	NA	NA	NA	NA	NA	NA

Spokane MSA Inventory A (in-use est.)
Emission Inventory Summary - VOC, NOx, CO

	tpy			tpsd		tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	948	16	7,385	5	0	0
Airport Service	29	178	265	0	0	1
Recreational	284	2	817	1	0	2
Recreational Marine	461	15	968	3	0	0
Light Commercial	302	32	3,983	1	0	11
Industrial	72	175	1,023	0	0	3
Construction	163	1,047	1,017	1	5	1
Agricultural	148	636	710	1	3	0
Logging	25	0	71	0	0	0
Marine Vessels	ND	ND	245	ND	ND	1
Nonroad Engines and Vehicles	2,432	2,101	16,485	12	10	19
Highway Vehicles	ND	ND	9,026	ND	ND	251
Other Area and Point Sources	ND	ND	77,748	ND	ND	224
All Sources	NA	NA	103,259	NA	NA	494

Spokane MSA Inventory A (in-use est.)
Emission Inventory Summary - VOC, NOx, CO
Percent of Total Inventory

	% total tpy			% total tpsd		% total tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	NA	NA	7.15%	NA	NA	0.04%
Airport Service	NA	NA	0.26%	NA	NA	0.15%
Recreational	NA	NA	0.79%	NA	NA	0.40%
Recreational Marine	NA	NA	0.94%	NA	NA	0.00%
Light Commercial	NA	NA	3.86%	NA	NA	2.21%
Industrial	NA	NA	0.99%	NA	NA	0.57%
Construction	NA	NA	0.99%	NA	NA	0.23%
Agricultural	NA	NA	0.69%	NA	NA	0.09%
Logging	NA	NA	0.07%	NA	NA	0.04%
Marine Vessels	NA	NA	0.24%	NA	NA	0.14%
Nonroad Engines and Vehicles	NA	NA	15.96%	NA	NA	3.86%
Highway Vehicles	NA	NA	8.74%	NA	NA	50.84%
Other Area and Point Sources	NA	NA	75.29%	NA	NA	45.29%
All Sources	NA	NA	100.00%	NA	NA	100.00%

Spokane MSA Inventory A (in-use est.)
Emission Inventory Summary - Air Toxics and SOx

Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
	tpy					
Lawn & Garden	15	5	26	11	98	5
Airport Service	20	1	1	0	1	12
Recreational	4	1	8	4	14	0
Recreational Marine	23	2	13	6	30	2
Light Commercial	7	2	9	4	26	5
Industrial	14	3	2	1	5	9
Construction	124	19	5	2	5	91
Agricultural	117	19	4	2	3	50
Logging	1	0	1	0	1	0
Marine Vessels	ND	ND	ND	ND	ND	ND
Nonroad Engines and Vehicles	325	52	69	30	184	173
Highway Vehicles	3,881	ND	ND	ND	ND	ND
Other Area and Point Sources	9,837	ND	ND	ND	ND	ND
All Sources	14,043	NA	NA	NA	NA	NA

Spokane MSA Inventory A (in-use est.)
Emission Inventory Summary - Air Toxics and SOx
Percent of Total Inventory

Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
	% total tpy					
Lawn & Garden	0.11%	NA	NA	NA	NA	NA
Airport Service	0.14%	NA	NA	NA	NA	NA
Recreational	0.03%	NA	NA	NA	NA	NA
Recreational Marine	0.17%	NA	NA	NA	NA	NA
Light Commercial	0.05%	NA	NA	NA	NA	NA
Industrial	0.10%	NA	NA	NA	NA	NA
Construction	0.88%	NA	NA	NA	NA	NA
Agricultural	0.83%	NA	NA	NA	NA	NA
Logging	0.01%	NA	NA	NA	NA	NA
Marine Vessels	0.00%	NA	NA	NA	NA	NA
Nonroad Engines and Vehicles	2.32%	NA	NA	NA	NA	NA
Highway Vehicles	27.64%	NA	NA	NA	NA	NA
Other Area and Point Sources	70.05%	NA	NA	NA	NA	NA
All Sources	100.00%	NA	NA	NA	NA	NA

Washington DC MSA Inventory A (in-use est.)
Emission Inventory Summary - VOC, NOx, CO

	tpy			tpsd		tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	12,255	206	99,980	49	1	49
Airport Service	423	2,589	3,763	1	7	10
Recreational	1,697	12	4,371	4	0	16
Recreational Marine	2,218	181	7,554	13	1	2
Light Commercial	2,156	228	28,516	6	1	78
Industrial	480	1,158	6,782	1	3	19
Construction	2,797	17,850	17,389	12	74	29
Agricultural	555	2,371	2,718	2	10	2
Logging	239	1	691	1	0	2
Marine Vessels	806	227	2,820	2	1	8
Nonroad Engines and Vehicles	23,626	24,822	174,584	92	98	214
Highway Vehicles	ND	83,068	398,686	345	250	2,161
Other Area and Point Sources	ND	88,336	59,024	202	242	167
All Sources	NA	196,226	632,294	639	591	2,541

Washington DC MSA Inventory A (in-use est.)
Emission Inventory Summary - VOC, NOx, CO
Percent of Total Inventory

	% total tpy			% total tpsd		% total tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	NA	0.11%	15.81%	7.72%	0.15%	1.94%
Airport Service	NA	1.32%	0.60%	0.18%	1.20%	0.41%
Recreational	NA	0.01%	0.69%	0.66%	0.00%	0.63%
Recreational Marine	NA	0.09%	1.19%	2.11%	0.19%	0.07%
Light Commercial	NA	0.12%	4.51%	0.93%	0.11%	3.07%
Industrial	NA	0.59%	1.07%	0.21%	0.54%	0.73%
Construction	NA	9.10%	2.75%	1.82%	12.59%	1.12%
Agricultural	NA	1.21%	0.43%	0.38%	1.76%	0.07%
Logging	NA	0.00%	0.11%	0.10%	0.00%	0.07%
Marine Vessels	NA	0.12%	0.45%	0.35%	0.11%	0.30%
Nonroad Engines and Vehicles	NA	12.65%	27.61%	14.46%	16.64%	8.42%
Highway Vehicles	NA	42.33%	63.05%	53.95%	42.38%	85.02%
Other Area and Point Sources	NA	45.02%	9.33%	31.59%	40.97%	6.56%
All Sources	NA	100.00%	100.00%	100.00%	100.00%	100.00%

Washington DC MSA Inventory A (in-use est.)
Emission Inventory Summary - Air Toxics and SOx

Equipment Category	PM	Aldehydes	Benzene	tpy 1,3 But.	Gas. Vap.	SOx
Lawn & Garden	213	65	344	144	1,201	62
Airport Service	290	13	13	6	8	171
Recreational	25	4	50	21	69	2
Recreational Marine	96	15	60	26	237	16
Light Commercial	50	15	62	26	185	33
Industrial	[illegible]3	20	14	6	34	58
Construction	2,115	328	82	42	80	1,555
Agricultural	436	72	16	8	11	185
Logging	9	1	7	3	13	0
Marine Vessels	ND	ND	ND	ND	ND	ND
Nonroad Engines and Vehicles	3,328	532	647	282	1,838	2,083
Highway Vehicles	ND	ND	ND	ND	ND	ND
Other Area and Point Sources	ND	ND	ND	ND	ND	ND
All Sources	NA	NA	NA	NA	NA	NA

Washington DC MSA Inventory A (in-use est.)
Emission Inventory Summary - Air Toxics and SOx
Percent of Total Inventory

Equipment Category	PM	Aldehydes	Benzene	% total tpy 1,3 But.	Gas. Vap.	SOx
Lawn & Garden	NA	NA	NA	NA	NA	NA
Airport Service	NA	NA	NA	NA	NA	NA
Recreational	NA	NA	NA	NA	NA	NA
Recreational Marine	NA	NA	NA	NA	NA	NA
Light Commercial	NA	NA	NA	NA	NA	NA
Industrial	NA	NA	NA	NA	NA	NA
Construction	NA	NA	NA	NA	NA	NA
Agricultural	NA	NA	NA	NA	NA	NA
Logging	NA	NA	NA	NA	NA	NA
Marine Vessels	NA	NA	NA	NA	NA	NA
Nonroad Engines and Vehicles	NA	NA	NA	NA	NA	NA
Highway Vehicles	NA	NA	NA	NA	NA	NA
Other Area and Point Sources	NA	NA	NA	NA	NA	NA
All Sources	NA	NA	NA	NA	NA	NA

Appendix N. EPA Use of Manufacturer Data In Inventory B

In developing activity levels for Inventory B, EPA used data supplied by manufacturers or manufacturer associations where it was available. In some cases, EPA had to adjust data for use in the inventory.

The kinds of data supplied and the adjustments to the data are detailed below. Part 1 is a general overview of the data supplied by manufacturers and used by EPA in constructing Inventory B. Part 2 contains more detailed adjustments made to the data for use in the inventory.

1. General Overview

1.1. Equipment Manufacturers Institute (EMI)

EMI provided population data for several types of agricultural and construction equipment. These equipment types are listed in Table N-01. Estimates of average engine-rated horsepower, annual use, and load factors were also available for these equipment types.

EMI estimates for crawler loaders were considered together with crawler tractors as fitting within the Inventory A estimate for crawler tractors. Because cotton pickers were included in Inventory A under "other agricultural equipment," EMI's cotton picker estimates were only considered in areas where the populations were higher than the Inventory A estimate for other agricultural equipment.

There were several equipment types for which population estimates were not provided by EMI, but for which EPA incorporated horsepower, annual use, and load factor estimates from EMI in developing Inventory B. These included swathers ("windrowers"), mobile elevating work platforms ("aerial lifts"), landfill compactors ("crushing/processing equipment"), and square balers and bale wagons ("balers"). Because of either negligible equipment populations or the absence of any matching equipment type, data for the following equipment types was not considered: leaf loaders, milling machines, horizontal earth borers, forage harvesters, augers, and cranes.

Additional adjustments to EMI data are detailed below in Part 2.

Table N-01. EMI Agricultural and Construction Equipment Data

Equipment Type	EMI Data
Crawler tractors	Crawler tractors Crawler loaders
Rubber tired loaders	Wheeled loaders
Scrapers	Scrapers
Graders	Motor graders
Off-highway trucks	Dumpers
Excavators	Crawler excavators Wheeled excavators
Tractors/loaders/backhoes	Backhoe loaders
Skid steer loaders	Skid steer loaders
Skidder (logging)	Log skidders
Rollers	Rollers and Compactors
Asphalt pavers Concrete pavers	Pavers
Other Agricultural Equip.	Cotton pickers

1.2. Outdoor Power Equipment Institute, Inc. (OPEI)

OPEI provided data on nonhandheld equipment types shown below in Table N-02. EPA combined OPEI's separate estimates for lawn tractors and garden tractors to replace the data for lawn and garden tractors from Inventory A.

OPEI supplied test data which were used to calculate load factors for lawnmowers, rear engine riding mowers, front mowers, and lawn and garden tractors. For other equipment types, EPA used the CARB load factors in Inventory B.

Because OPEI reported separate annual hours of use estimates for commercial and consumer use, EPA used OPEI's reported percentages of such use to construct weighted average annual hours of use estimates. These and other adjustments to OPEI data are detailed in a later section.

Table N-02. OPEI Nonhandheld Lawn and Garden Equipment Data

Equipment Type	OPEI Data
Lawnmowers	Walk behind mowers
Rear engine riding mowers	Riding mowers
Lawn and garden tractors	Lawn tractors Garden Tractors
Tillers < 5 hp	Walk behind tillers

1.3. Portable Power Equipment Manufacturers Association (PPEMA)

PPEMA provided local and national population data for those types of handheld equipment shown in Table N-03.

Table N-03. PPEMA Handheld Lawn and Garden Equipment Data

Equipment Type	PPEMA Data
Leaf blowers/vacuums (2-stroke)	Backpack blowers Hand blowers
Trimmers/edgers/brush cutters (2-stroke)	Hedge trimmers Trimmer/brush cutter
Chain saws < 4 hp Chain saws > 4 hp	Consumer chain saws Commercial chain saws

PPEMA also provided annual hours of use, horsepower, and load factor data. EPA's use of this data is detailed in a later section.

1.4. Industrial Truck Association (ITA)

ITA provided load factor, annual hours of use, and CMSA-level population estimates for industrial forklifts, which were used in Inventory B as provided.

1.5. International Snowmobile Industry Association (ISIA)

ISIA provided national population and annual hours of use estimates for snowmobiles. To obtain CMSA-level populations, EPA multiplied CMSA-level populations from Inventory A by the ratio of ISIA national populations to Inventory A national populations.

1.6. National Marine Manufacturers Association (NMMA)

Population Data -- Local boat registrations were used to establish the number of boats of each equipment type owned in each nonattainment area, as was done for Inventory A. The same method was also used to calculate the number of engines from the number of boats. However, NMMA requested that the adjustment for the number of engines actually used in the nonattainment areas be handled differently than was done for Inventory A. Rather than directly rely on the ratio of the reported fuel consumed in the nonattainment areas to the reported fuel used by boats registered in the nonattainment area from the IB&A survey, NMMA requested that the adjustment be handled by a formula based upon the water surface area per registered boat in the nonattainment area.

The formula was derived from the relationship between water surface area per registered boat and the reported ratio of fuel consumed in the nonattainment areas to the fuel consumed by boats registered in the nonattainment area for the eight surveyed areas. Equations of the form $Y = 1 - \exp^{(kX))**m}$ provided the best fit to the data, where

Y = ratio of fuel used in the nonattainment area (from boats registered both inside and outside the nonattainment area) to total fuel used by boats registered in nonattainment area (includes fuel used outside the nonattainment area)
X = local water surface area/registered boat in nonattainment area
k and m are coefficients

The value of m was used to calibrate the formula such that the highest r^2 values were obtained without yielding larger values for y in any nonattainment area than the ratio of the theoretical maximum number of summer boat hours inside a nonattainment area to the total summer hours of use calculated for boats registered in a nonattainment area. This ratio was calculated as follows:

$$\frac{\left[\dfrac{\text{water surface area in n/a area}}{\text{area req/boat}}\right](384)}{(\text{summer usage})\left[\sum_i (\#\ \text{n/a boats})\ (\text{hours})\left(\dfrac{\text{fuel used in n/a area}}{\text{fuel used by boats registered in n/a area}}\right)\right]}$$

The definition of the above terms and the derivation of this formula are discussed in Appendix K, Section 6.

The value of k was determined by the regression. The final formula developed was:

$$Y = 1 - \exp^{(238x)^{**}.66}$$

This formula was used to develop the basic ratio of fuel used in the nonattainment area to total fuel used by boats registered in the nonattainment area for each of the 24 areas. For those areas located on the ocean or the Great Lakes, the proportion of use within 1 mile offshore reported by the survey for the five areas on the ocean or a Great Lake were added to the basic ratio. The final ratio was multiplied by the number of engines registered in the nonattainment area to calculate the number of engines used in the nonattainment area.

Fuel Use -- For the eight surveyed areas, the average fuel use per engine reported in the survey for boats registered in the nonattainment area were used in the inventory calculations. For the nonsurveyed areas, NMMA submitted a national average fuel use estimate for outboard motors of 91 gallons/year. This estimate was based on the amount of 2-stroke marine motor oil consumed each year. The average fuel use reported in the survey for outboard motors was 142 gallons/year. NMMA requested that EPA use the 91 gallons/year estimate for outboard motors for all of the unsurveyed areas, and scale the average fuel use reported by the survey for the other equipment types by the outboard motor factor, i.e., 91/142.

Seasonal Adjustment Factors -- As was done for Inventory A, the proportion of boat use in the summer and the winter was based on monthly usage reported by the survey respondents.

1.7. Motorcycle Industry Council, Inc. (MIC)

MIC provided EPA with survey information on the number of miles ridden annually by ATVs and off-highway motorcycles.* An average speed of 25 miles per hour was assumed in order to convert these figures into hours per year. MIC also provided national population figures, which were distributed to the local level using the ratio of the local to national population estimate for Inventory A. The same distribution between 2-stroke and 4-stroke versions as reported by EEA was used in developing Inventory B.

2. Detailed Adjustments

2.1. Equipment Manufacturers Institute (EMI)

EMI supplied load factor, horsepower, annual hours of use, national and CMSA-level population data for various types of construction equipment. The data supplied and the adjustments made to the data are detailed below.

Equipment Type	EMI Data and Adjustment
Crawler Tractor	EMI supplied national horsepower and load factor, as well as national and CMSA level populations and hours/year separately for crawler loaders and tractors. National hours/year were estimated by population weighting the regional values supplied by EMI over all 24 areas. To estimate aggregated hours/year for all crawler loaders and tractors at the regional level, EPA population weighted the regional values for both equipment

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* Letter to John German (EPA) from J.C. Delaney, Manager of Technical Programs, MIC, June 6, 1991.

Equipment Type	EMI Data and Adjustment
	types. To estimate aggregated horsepower and load factor at the national level, EPA weighted data for both types by (population) (hours/year) and (population) (hours/year) (horsepower), respectively.
Rubber Tired Loader	For wheel loaders EMI supplied national population, horsepower, and load factor, as well as CMSA level populations and hours/year. EPA estimated national hours of use by population weighting regional values over 23 nonattainment areas.
Scraper	For scrapers, EMI supplied data as for rubber tired loaders.
Graders	For motor graders, EMI supplied data as for rubber tired loaders.
Off-Highway Trucks	For dumpers (off-road haulers), EMI supplied data as for rubber tired loaders.
Excavators	EMI supplied national horsepower and load factor, as well as CMSA level populations and hours/year separately for crawler and wheel excavators. EMI also supplied national populations for all excavators - EPA assumed a uniform national distribution of crawler and wheel versions. National hours/year were estimated by population weighting the regional values supplied by EMI over all 24 areas. To estimate aggregated hours/year for all excavators at the regional level, EPA population weighted the regional values for both types of excavators. To estimate aggregated horsepower and load factor at the national level, EPA weighted crawler and wheel data by (population) (hours/year) and (population) (hours/year) (horsepower), respectively.
Tractor/Loaders/Backhoes	EMI supplied data for backhoe loaders as for rubber tired loaders.
Skid Steer Loaders	EMI supplied data for skid steer loaders as for rubber tired loaders.
Skidder (logging)	EMI supplied data for log skidders as for rubber tired loaders, except that national populations were not provided.
Rollers	EMI supplied data for rollers and compactors as for rubber tired loaders.
Asphalt pavers	EMI supplied data for asphalt pavers as for rubber tired loaders.

Equipment Type	EMI Data and Adjustment
Concrete pavers	EMI supplied only a national population estimate for concrete pavers.
Cranes	EMI supplied only a national population estimate for cranes.
Trenchers	EMI supplied only estimates of the national population, average rated horsepower, and load factor for trenchers.
Rough Terrain Forklifts	EMI supplied data for rough terrain forklifts as for trenchers.
Other Agricultural Equipment	EMI supplied data for cotton pickers as for rubber tired loaders.
Balers	EMI supplied local population and annual use estimates for square balers and bale wagons, as well as national data for horsepower and load factor. To estimate national hours per year for both versions individually, EPA weighted regional values over all 24 areas. EPA estimated aggregated hours per year for all balers at the regional level by population weighting regional values. At the national level, EPA estimated aggregated hours per year, horsepower, and load factor by weighting regional values by population, (population) (hours/year) and (population) (hours/year) (horsepower), respectively.
Aerial Lifts	EMI supplied only horsepower and load factor data for mobile work platforms.

In the draft version of this study, data submitted by EMI for combines and agricultural tractors was used to construct Inventory B. This included population figures developed by the U.S. Bureau of the Census, which EMI has stated may include seldom-used equipment. However, EMI has cautioned that, in constructing an emission inventory, appropriate corrections should be made to either the operative population estimate or the estimate of average annual usage. EMI's submitted data contained no such correction. Consequently, the final version of Inventory B uses the same data as Inventory A for these two types of equipment.

2.2. OPEI Data

Population Data -- CMSA population data for lawnmowers, riding mowers, lawn tractors, garden tractors and tillers were supplied by OPEI[†]. However, because these categories do not fully match those equipment types used in the nonroad study, some aggregation and disaggregation was necessary. Lawn tractors and garden tractors were combined to obtain a value for "Lawn and Garden Tractors". The tiller population was disaggregated into "Tillers < 5 hp" and "Tillers > 5 hp" and the riding mower population was disaggregated into "Front Mowers" and "Rear Engine Riding Mowers". In addition, all equipment populations were disaggregated into 2- and 4-stroke diesel and gasoline equipment types per EEA's methodology for each CMSA[‡] as shown below.

Tillers < 5 hp and Tillers > 5 hp

For each tiller type, the following calculation was made:

$$\left(\frac{Pop_{Stroke\ type,\ Fuel\ type,\ HP\ Range}}{Tiller\ Total\ Pop}\right)_{EEA\ CMSA} \times (Tiller\ Total\ Pop)_{OPEI\ CMSA}$$

$$= (Pop_{Stroke\ type,\ Fuel\ type,\ HP\ Range})_{OPEI\ CMSA}$$

[†] "Information Regarding Selected Outdoor Power Equipment", prepared by OPEI for EPA, April 25, 1991, plus addendum. According to Mary Washburne this data includes diesel as well as gasoline equipment (conversation of Sept. 9, 1991).

[‡] Two EPA CMSAs (i.e., South Coast and San Joaquin) don't match OPEI's regions. For the San Joaquin Valley, EEA population numbers were used and for the South Coast Air Basin CMSA, OPEI's L.A. populations were used.

Lawn and Garden Tractors

$$\left(\frac{(L+G\ Population)_{Stroke,\ Fuel}}{Lawn\ +\ Garden\ total}\right)_{EEA\ CMSA} \times (Lawn\ Pop + Garden\ Pop)_{OPEI\ CMSA}$$

$$= ((L+G\ Population)_{Stroke,\ Fuel})_{OPEI\ CMSA}$$

Front Mowers and Rear Engine Riding Mowers

$$\left(\frac{Stroke\ type,\ Fuel\ type,\ Equip.\ Type}{Front+\ Rear\ Engine\ Riding\ Mower\ Tot.}\right)_{EEA\ CMSA} \times (Riding\ Mower\ Tot.)_{OPEI\ CMSA}$$

$$= (Stroke\ type,\ Fuel\ type,\ Equip.\ Type)_{OPEI\ CMSA}$$

In some cases OPEI did not provide data for a particular CMSA, and EPA used data from Inventory A. These cases are identified below:

Walk Behind Lawnmowers
Fresno, CA
Provo-Orem, UT

Riding Mowers
Bakersfield, CA
Fresno, CA
Provo-Orem, UT
San Diego, CA

Lawn Tractors
Bakersfield, CA
Fresno, CA
Provo-Orem, UT
San Diego, CA

Garden Tractors
Bakersfield, CA
El Paso, Tx
Fresno, CA
Miami, FL
Provo-Orem, UT
Spokane, WA

Walk Behind Tillers
Bakersfield, CA
Baton Rouge, LA
Miami, FL
Minneapolis-St. Paul, MN
Provo-Orem, UT
Springfield, MA

Hours of Use -- Hours of use data were taken from the OPEI report to EPA[9]. Additional assumptions specific to the equipment type are described below.

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[9] The average of Bakersfield and Fresno values were taken for the San Joaquin Valley and L.A. values were assumed for the South Coast Air Basin CMSA.

Lawn and Garden Tractors

Hours of use for lawn tractors and garden tractors were population weighted based on OPEI CMSA populations to get annual hours of use for "Lawn and Garden Tractors" for each CMSA. For example, the Baltimore CMSA 4-stroke diesel lawn and garden tractor annual usage number is:

$$\frac{40{,}000 \text{ } \mathit{lawn\ tractors} \times 41 \text{ } \mathit{hrs} + 29{,}326 \text{ } \mathit{garden\ tractors} \times 56 \text{ } \mathit{hrs}}{40{,}000 + 29{,}326} = 47.3 \text{ } \mathit{hrs}$$

Tillers < 5 hp and Tillers > 5 hp

Hours of use for tillers were weighted by commercial and consumer populations provided by OPEI in the addendum to their report. OPEI suggested that 18% of all tillers are used commercially and that 82% are used by consumers. Commercially used tillers are assumed to operate 4 times as much as consumer tillers. Thus, the local consumer hours of use reported by OPEI for each area was multiplied by 1.54 to obtain overall hours of use, as follows:

$$\frac{0.82 \times (\#\text{ consumer hours}) + 0.18 \times (\#\text{ consumer hours} \times 4)}{(.82 + (.18 \times 4)\ (\#\text{ consumer hours})} = (1.54)\ (\#\text{ consumer hours})$$

Tillers above and below 5 hp were assumed to have the same usage characteristics.

Front Mowers and Rear Engine Riding Mowers

Hours of use for "Front Mowers" and "Rear Engine Riding Mowers" were assumed equal to the riding mower value supplied by OPEI for each CMSA. This assumption will probably underestimate the annual hours of use for "Front Mowers" because they are used commercially while "Rear Engine Riding Mowers" are not.

Lawnmowers

Hours of use for lawnmowers are also weighted by commercial and consumer populations as well as 2-stroke and 4-stroke populations. Based upon sales, useful life, and usage information supplied by OPEI, 94.8% of all lawnmowers are consumer and 5.3% are commercial, with commercial mowers operating 16 times as much as consumer mowers. Of the consumer lawnmowers, 90% are 4-stroke and 10% are 2-stroke. Of the commercial lawnmowers, 85% are 4-stroke and 15% are 2-stroke. Thus, the local consumer hours reported by OPEI for each area was multiplied by 2.17 to obtain overall average hours of use for 2-stroke lawnmowers, as follows:

$$\frac{\begin{array}{l} 0.948 \times 0.10 \times (\#\ \text{consumer hours}) \\ +0.053 \times 0.15 \times (16 \times \#\ \text{consumer hours}) \end{array}}{(0.948 \times 0.10) + (0.052 \times 0.15)} = (2.170)\ (\#\ \text{consumer hours})$$

Similarly, the local consumer hours reported by OPEI for each area was multiplied by 1.75 to obtain overall average hours of use for 4-stroke lawnmowers, as follows:

$$\frac{\begin{array}{l} 0.948 \times 0.90 \times (\#\ \text{consumer hours}) \\ +0.053 \times 0.85 \times (16 \times \#\ \text{consumer hours}) \end{array}}{(0.948 \times 0.90) + (0.052 \times 0.85)} = (1.75)\ (\#\ \text{consumer hours})$$

Horsepower -- Horsepower data for "Lawnmowers", "Rear Engine Riding Mowers", "Lawn and Garden Tractors", and tillers were calculated from the OPEI report by weighting population only, as hours of use were not available. The calculations are shown below:

Walk-Behind Lawnmowers

$$\begin{array}{rr} 3.0\,(+\ \textit{less}) & \times\ 0.08 \\ +\ 3.5 & \times\ 0.60 \\ +\ 4.5 & \times\ 0.20 \\ +\ 5.0\,(+\ \textit{more}) & \times\ 0.12 \\ \hline & 3.84\ \textit{HP} \end{array}$$

Rear Engine Riding Mowers and Front Mowers

8.0 (+ *less*) × 0.13
+ 9.0 × 0.34
+ 11.0 × 0.26
+ 12.0 (+ *more*) × 0.27

10.2 *HP*

Lawn and Garden Tractors

Garden Tractors:

12 (+ *less*) : 12 × 0.19
+ 12 - 13.9 : 13 × 0.30
+ 14 - 15.9 : 15 × 0.08
+ 16 - 17.9 : 17 × 0.11
+ 18 - 19.9 : 19 × 0.21
+ 20 (+ *more*) : 20 × 0.11

15.44 *HP*

Lawn Tractors:

12 (+ *less*) : 8.0 × 0.33
+ 12 - 13.9 : 12.3 × 0.42
+ 14 - 15.9 : 15.0 × 0.05
+ 16 - 17.9 : 17.0 × 0.07
+ 18 (+ *more*) : 19.0 × 0.13

12.4 *HP*

Lawn and Garden Tractors	**Population**	**Usage Ratio**	**hp**	
Lawn Tractors	75%	3	12.40	2,790
Garden Tractors	25%	4	15.35	1,535
		325.00		4,325
Average horsepower =			13.31	

Tillers < 5 hp

Tillers below 5 hp had to be disaggregated as follows:

$$\frac{3.9\ (+\ \mathit{less})\times 0.14 + 4.5 \times \frac{0.77}{2}}{0.14 + \frac{0.77}{2}} = 4.34\ HP$$

Tillers > 5 hp

Tillers above 5 hp had to be disaggregated as follows:

$$\frac{6.0\ (+\ \mathit{more})\times 0.09 + 5.5 \times \frac{0.77}{2}}{0.09 + \frac{0.77}{2}} = 5.59\ HP$$

Commercial Turf Equipment

The population weighted average horsepower of multi-spindle walk behind mowers was assumed for the "Commercial Turf Equipment" category:

$$\begin{array}{rr} 8.0\ (+\ \mathit{less}) & \times\ 0.04 \\ +\ 10.5 & \times\ 0.58 \\ +\ 13.1\ (+\ \mathit{more}) & \times\ 0.38 \\ \hline & 11.4\ HP \end{array}$$

Data for weighting the horsepowers by usage was not available.

Load Factor Data -- In a letter to EPA dated September 9, 1991, OPEI discussed the fact that some types of lawn and garden equipment are fitted with a governor that prevents the engine from reach the RPM at which the rated power (as advertised) is measured. One means of accounting for this discrepancy between the rated and governed maximum power is to decrease the applicable load factor. Based on data included in this letter, the following load factors were calculated for use in Inventory B:

Lawnmowers - 30%
Rear engine riding mowers - 38%
Front mowers - 38%
Lawn and garden tractors - 38%

In all other cases, the load factors for lawn and garden equipment used in Inventory B were the same as those used in Inventory A.

2.3. PPEMA Data

Population data -- Population data were taken from a Heiden report[f] for 2-stroke gasoline "Trimmers/Edgers/Brush Cutters"[**], "Leaf Blowers/Vacuums", "Chain Saws < 4 hp", and "Chain Saws > 4 hp". In an earlier version of this report, Heiden proposed a methodology that relied on urban single family housing units (SFHUs), rural SFHUs, and SIC 078 (landscaping and horticulture services) employment. However, because the regression coefficient for urban SFHUs was negative in the case of chain saws and blowers, Heiden developed on additional model that relies on urban population [human] outside major urbanized areas, rural population, and SIC 078 employment. For these two types of equipment, this additional methodology was used to construct Inventory B. For trimmers, the original methodology proposed by Heiden was used, as no other model was clearly superior on either an econometric or intuitive basis.

The PPEMA chain saw population was distributed to over and under 4 hp ranges based on the distribution reported by EEA.

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[f] Heiden Associates, Inc. *Estimates of 24 Nonattainment Area Portable Two-Stroke Power Equipment Populations Based on Actual Industry Shipment Data and Four Alternative Activity Models*, sponsored by the Portable Power Equipment Manufacturers Association. October 30, 1991.

[**] Quotes (" ") identify equipment types which are included in EEA's final equipment list. Equipment types not written in quotes are manufacturer or otherwise defined.

Usage Data -- Usage data for hand blowers, back blowers, trimmers/brush cutters, hedgetrimmers, chain saws and cut off saws for commercial (professional) and consumer were supplied by PPEMA in an earlier Heiden report.[††] That data was population weighted to obtain average annual hours of use values for "Trimmers/Edgers/Brush Cutters", "Leaf Blowers/Vacuums", "Chain Saws < 4 hp" and "Chain Saws > 4 hp". National population data were provided in the October 30, 1991 Heiden report (see Population Data above). Calculations for each of these equipment types are shown below:

Leaf Blowers/Vacuums

$$\frac{\begin{array}{r} 62{,}114\ \textit{Comm Hand Blwrs} \times 197\ \textit{hrs} \\ +\ 3{,}134{,}445\ \textit{Cons Hand Blwrs} \times 9\ \textit{hrs} \\ +\ 154{,}052\ \textit{Comm Back Blwrs} \times 293\ \textit{hrs} \\ +\ 25{,}815\ \textit{Cons Back Blwrs} \times 12\ \textit{hrs} \end{array}}{62{,}114 + 3{,}134{,}445 + 154{,}052 + 25{,}815} = 25.4\ \textit{hrs}$$

Trimmers/Edgers/Brush Cutters

$$\frac{\begin{array}{r} 695{,}274\ \textit{Comm L Trimmers/B Cutters} \times 170\ \textit{hrs} \\ +\ 12{,}531{,}475\ \textit{Cons L Trimmers/B Cutters} \times 10\ \textit{hrs} \\ +\ 179{,}259\ \textit{Comm Hedgetrimmers} \times 75\ \textit{hrs} \\ +\ 47{,}649\ \textit{Cons Hedgetrimmers} \times 7\ \textit{hrs} \end{array}}{695{,}274 + 12{,}531{,}475 + 179{,}259 + 47{,}649} = 19.1\ \textit{hrs}$$

Chain Saws > 4 hp

Chain saws over 4 hp are assumed to operate the same number of hours as commercial chain saws (405 hrs/yr).

Chain Saws < 4 hp

The hours of use value for chain saws < 4 hp were obtained by default through the calculation of average horsepower for chain saws < 4 hp. The calculation of average horsepower and subsequent back calculation of hours of use is shown below.

[††] "A 1989 California Baseline Emissions Inventory for Total Hydrocarbon & Carbon Monoxide Emissions from Portable Two-Stroke Power Equipment" prepared by Heiden Associates, Inc. for PPEMA, July 24, 1990.

From PPEMA data:

	Population	Usage	hp	Product
Commercial Chain Saws	344,599	405	4.1	572,206,640
Consumer Chain Saws	7,576,254	7	1.5	79,550,667
	192,596,373			651,757,307
Average Horsepower = 3.38				

From data supplied by EEA:

- 0.32% of chain saws have engines greater than 4 hp.
- 99.68% of chain saws have engines less than 4 hp.
- For those that are > 4 hp, the average horsepower is 6.4 hp.

Therefore, by subtracting the number of hp-hrs attributable to the chain saws > 4 hp from the total number of hp-hrs, average hp and average hours of use for chain saws < 4 hp may be obtained:

$$651{,}757{,}306\ \frac{hp\text{-}hrs}{yr} - 0.0032 \times 7{,}920{,}853 \times 405\ \frac{hrs}{yr} \times 6.4\ hp = 586{,}057{,}882\ \frac{hp\text{-}hrs}{yr}$$

Solving for average horsepower:

$$\frac{586{,}057{,}882\ \frac{hp\text{-}hrs}{yr}}{182{,}330{,}838\ \frac{hrs}{yr}} = 3.21\ hp$$

Solving for average hours of use:

$$\frac{182{,}330{,}838\ unit\text{-}hrs}{0.9968 \times 7{,}920{,}853\ units} = 23.1\ hrs$$

Horsepower Data -- Horsepower data for chain saws, trimmers/brush cutters, hand blowers, back blowers and hedgetrimmers are taken from the 1990 Heiden report (page 18).

The horsepower for chain saws over 4 hp has been provided by EEA (6.4 hp). The average horsepower value used for chain saws less than 4 hp is 3.21 hp and was derived in the discussion earlier regarding the hours of use for chain saws less than 4 hp. The other horsepower values supplied in the Heiden Report have been population and usage weighted to provide average horsepowers for "Trimmers/Edgers/Brush Cutters" and "Leaf Blowers/Vacuums" as shown below:

Trimmers/Edgers/Brush Cutters	Population	Usage	hp	
Comm. Trim/Brush Cut.	695,274	170	1.9	224,573,502
Comm. Hedgetrimmers	179,259	75	1.9	25,544,408
Cons. Trim/Brush Cut.	12,531,475	10	.7	87,720,325
Cons. Hedgetrimmers	47,649	7	.7	233,480
		257,289,298		338,071,715
		Average horsepower =	1.31	

Leaf Blowers/Vacuums	Population	Usage	hp	
Comm. Hand Blowers	62,114	197	.8	9,789,166
Comm. Bkpk Blowers	154,052	293	3.0	135,411,708
Cons. Hand Blowers	3,134,445	9	.8	22,568,004
Cons. Bkpk Blowers	25,815	12	3.0	929,340
		85,893,479		168,698,168
		Average Horsepower =	1.96	

Load Factor Data -- Heiden suggested in the same report[‡‡] that most portable 2-stroke gasoline equipment operated at 50% of rated speed and full load. Therefore, a load factor of 50% is assumed for "Trimmers/Edgers/Brush Cutters", "Leaf Blowers/Vacuums", "Chain Saws < 4 hp" and "Chain Saws > 4 hp".

[‡‡] Ibid. page 6.

2.4. Other Sources of Data

CARB Data -- All CARB data has been taken from the Technical Support Document (TSD) attachment C[††]. Only where OPEI or PPEMA have not submitted values has CARB data been used, when available, for lawn and garden equipment.

Hours of Use

Shredders > 5 hp and Shredders < 5 hp

All shredders are assumed to have the same usage rate, regardless of horsepower. The usage has been weighted by consumer and commercial populations:

$$\begin{array}{lr} \textit{Cons:} & .64 \times 16.5\ \textit{hrs} \\ \textit{Comm:} & +\ .34 \times 190\ \textit{hrs} \\ \hline & 75.2\ \textit{hrs} \end{array}$$

Snowblowers

Snowblowers are assumed the same as snowthrowers.

$$\begin{array}{lr} \textit{Cons:} & .90 \times 10\ \textit{hrs} \\ \textit{Comm:} & +\ .10 \times 60\ \textit{hrs} \\ \hline & 15\ \textit{hrs} \end{array}$$

Commercial Turf Equipment

The specialized turf care value supplied by CARB is utilized since both categories are predominately wide area walk behind mowers. The value is 800 hours per year.

[††] California Air Resources Board. *Technical Support Documents for California Exhaust Emission Standards and Test Procedures for 1994 and Subsequent Model Year Utility and Lawn and Garden Equipment Engines.* Attachment C to CARB Mailout #90-64. El Monte, CA:State of California, December 1991.

Horsepower

Snowblowers

Based on industry suggestions, different horsepowers for 2- and 4-cycle engines are used.

4-Cycle Engines:

CARB reports average horsepowers for consumer and commercial snowthrowers. Those horsepowers have been population and usage rate weighted to find the average 4-cycle horsepower for snowblowers[££]:

$$\frac{\begin{array}{rr} \underline{\mathit{Cons}}: & .90 \times 10\ \mathit{hrs} \times 4.5\ \mathit{HP} \\ \underline{\mathit{Comm}}: & +\ .10 \times 60\ \mathit{hrs} \times 6.0\ \mathit{HP} \end{array}}{(.90 \times 10) + (.10 \times 60)} = 5.1\ \mathit{HP}$$

2-Cycle Engines:

The average 2-cycle horsepower for snowblowers was provided by LAWN-BOY[***]:

$$\begin{array}{rr} \textbf{\textit{Tecumseh Eng}}: & .75 \times 3.0\ \mathit{HP} \\ \underline{\textbf{\textit{Suzuki Eng}}\ \ :} & \underline{+\ .10 \times 4.5\ \mathit{HP}} \\ & 3.75\ \mathit{HP} \end{array}$$

[££] Note: The CARB data does contain 5% 2-cycle engines. Therefore, the weighing is slightly understated.

[***] Letter to Kevin Green (EPA), from Bob Carlson, Vice-President of Research and Engineering, Briggs & Stratton, October 16, 1991.

Appendix O. Emission Inventory B

Inventory B is presented in two sets of tables which summarize emissions from nonroad engines and vehicles, highway vehicles, and other area and point sources of emissions. Each set of tables summarizes emissions in each of the 24 nonattainment areas included in this study, as well as national emissions.

In the first set of summary tables, nonroad emissions are calculated using new engine emission factors. In the second set of summary tables, nonroad emissions are calculated using in-use emission factors.

USA Inventory B
Emission Inventory Summary - VOC, NOx, CO

Equipment Category	tpy VOC	NOx	CO	tpsd VOC	NOx	tpwd CO
Lawn & Garden	401,453	15,751	2,806,402	1,543	68	1,990
Airport Service	15,657	104,233	126,673	43	286	347
Recreational	343,626	5,659	608,482	304	6	4,896
Recreational Marine	705,977	46,724	1,934,235	4,276	292	424
Light Commercial	102,917	37,255	1,954,589	288	102	5,355
Industrial	68,125	168,934	990,935	195	463	2,715
Construction	116,538	885,926	607,593	486	3,689	999
Agricultural	194,906	937,142	849,397	854	4,108	559
Logging	11,446	62,781	55,947	31	172	153
Marine Vessels	543,464	218,799	1,822,527	1,489	599	4,993
Nonroad Engines and Vehicles	2,504,109	2,483,204	11,756,780	9,509	9,785	22,431
Highway Vehicles	5,639,454	6,547,763	36,034,743	16,996	19,733	84,904
Other Area and Point Sources	13,684,163	13,955,333	24,460,414	37,491	38,234	87,207
All Sources	21,827,726	22,986,300	72,251,937	63,996	67,752	194,542

USA Inventory B
Emission Inventory Summary - VOC, NOx, CO
Percent of Total Inventory

Equipment Category	% total tpy VOC	NOx	CO	% total tpsd VOC	NOx	% total tpwd CO
Lawn & Garden	1.84%	0.07%	3.88%	2.41%	0.10%	1.02%
Airport Service	0.07%	0.45%	0.18%	0.07%	0.42%	0.18%
Recreational	1.57%	0.02%	0.84%	0.47%	0.01%	2.52%
Recreational Marine	3.23%	0.20%	2.68%	6.68%	0.43%	0.22%
Light Commercial	0.47%	0.16%	2.71%	0.45%	0.15%	2.75%
Industrial	0.31%	0.73%	1.37%	0.31%	0.68%	1.40%
Construction	0.53%	3.85%	0.84%	0.76%	5.45%	0.51%
Agricultural	0.89%	4.08%	1.18%	1.34%	6.06%	0.29%
Logging	0.05%	0.27%	0.08%	0.05%	0.25%	0.08%
Marine Vessels	2.49%	0.95%	2.52%	2.33%	0.88%	2.57%
Nonroad Engines and Vehicles	11.47%	10.80%	16.27%	14.86%	14.44%	11.53%
Highway Vehicles	25.84%	28.49%	49.87%	26.56%	29.13%	43.64%
Other Area and Point Sources	62.69%	60.71%	33.85%	58.58%	56.43%	44.83%
All Sources	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

USA Inventory B
Emission Inventory Summary - Air Toxics and SOx

				tpy		
Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
Lawn & Garden	5,984	3,596	10,592	4,288	71,703	2,976
Airport Service	7,542	529	464	234	315	6,892
Recreational	12,678	1,325	9,846	4,236	17,772	509
Recreational Marine	38,557	4,635	18,871	8,104	83,076	4,844
Light Commercial	2,551	1,468	2,711	1,032	24,424	4,366
Industrial	6,807	2,901	1,840	800	8,873	6,647
Construction	72,702	17,284	3,431	1,772	3,631	77,443
Agricultural	105,151	28,259	5,762	3,044	3,310	73,117
Logging	5,423	1,190	331	152	877	5,193
Marine Vessels	16,204	ND	ND	ND	ND	24,604
Nonroad Engines and Vehicles	273,599	61,188	53,848	23,662	213,981	206,592
Highway Vehicles	1,397,738	ND	ND	ND	ND	652,572
Other Area and Point Sources	6,384,620	ND	ND	ND	ND	22,311,998
All Sources	8,055,957	NA	NA	NA	NA	23,171,162

USA Inventory B
Emission Inventory Summary - Air Toxics and SOx
Percent of Total Inventory

				% total tpy		
Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
Lawn & Garden	0.07%	NA	NA	NA	NA	0.01%
Airport Service	0.09%	NA	NA	NA	NA	0.03%
Recreational	0.16%	NA	NA	NA	NA	0.00%
Recreational Marine	0.48%	NA	NA	NA	NA	0.02%
Light Commercial	0.03%	NA	NA	NA	NA	0.02%
Industrial	0.08%	NA	NA	NA	NA	0.03%
Construction	0.90%	NA	NA	NA	NA	0.33%
Agricultural	1.31%	NA	NA	NA	NA	0.32%
Logging	0.07%	NA	NA	NA	NA	0.02%
Marine Vessels	0.20%	NA	NA	NA	NA	0.11%
Nonroad Engines and Vehicles	3.40%	NA	NA	NA	NA	0.89%
Highway Vehicles	17.35%	NA	NA	NA	NA	2.82%
Other Area and Point Sources	79.25%	NA	NA	NA	NA	96.29%
All Sources	100.00%	NA	NA	NA	NA	100.00%

Atlanta MSA Inventory B
Emission Inventory Summary - VOC, NOx, CO

	tpy			tpsd		tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	5,884	271	48,154	21	1	38
Airport Service	311	2,073	2,518	1	6	7
Recreational	232	5	718	1	0	1
Recreational Marine	1,474	84	3,628	8	0	3
Light Commercial	1,275	320	16,656	4	1	46
Industrial	936	2,166	14,018	3	6	38
Construction	1,801	13,617	9,154	7	49	20
Agricultural	337	1,584	1,370	1	6	1
Logging	91	111	300	0	0	1
Marine Vessels	0	0	ND	0	0	ND
Nonroad Engines and Vehicles	12,340	20,232	96,516	44	69	155
Highway Vehicles	ND	69,146	ND	319	208	ND
Other Area and Point Sources	ND	92,553	ND	287	248	ND
All Sources	NA	181,931	NA	650	526	NA

Atlanta MSA Inventory B
Emission Inventory Summary - VOC, NOx, CO
Percent of Total Inventory

	% total tpy			% total tpsd		% total tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	NA	0.15%	NA	3.20%	0.19%	NA
Airport Service	NA	1.14%	NA	0.13%	1.08%	NA
Recreational	NA	0.00%	NA	0.14%	0.00%	NA
Recreational Marine	NA	0.05%	NA	1.17%	0.08%	NA
Light Commercial	NA	0.18%	NA	0.55%	0.17%	NA
Industrial	NA	1.19%	NA	0.42%	1.13%	NA
Construction	NA	7.48%	NA	1.00%	9.36%	NA
Agricultural	NA	0.87%	NA	0.19%	1.12%	NA
Logging	NA	0.06%	NA	0.04%	0.06%	NA
Marine Vessels	NA	0.00%	NA	0.00%	0.00%	NA
Nonroad Engines and Vehicles	NA	11.12%	NA	6.84%	13.20%	NA
Highway Vehicles	NA	38.01%	NA	49.02%	39.61%	NA
Other Area and Point Sources	NA	50.87%	NA	44.13%	47.19%	NA
All Sources	NA	100.00%	NA	100.00%	100.00%	NA

Atlanta MSA Inventory B
Emission Inventory Summary - Air Toxics and SOx

Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
	tpy					
Lawn & Garden	86	56	154	62	1,127	51
Airport Service	150	11	9	5	6	137
Recreational	2	1	6	3	29	1
Recreational Marine	83	9	39	17	171	9
Light Commercial	38	16	35	14	209	38
Industrial	62	36	25	11	142	62
Construction	1,115	267	53	27	51	1,192
Agricultural	177	48	10	5	17	124
Logging	11	3	3	1	9	9
Marine Vessels	ND	ND	ND	ND	ND	ND
Nonroad Engines and Vehicles	1,724	446	334	144	1,761	1,623
Highway Vehicles	ND	ND	ND	ND	ND	ND
Other Area and Point Sources	ND	ND	ND	ND	ND	ND
All Sources	NA	NA	NA	NA	NA	NA

Atlanta MSA Inventory B
Emission Inventory Summary - Air Toxics and SOx
Percent of Total Inventory

Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
	% total tpy					
Lawn & Garden	NA	NA	NA	NA	NA	NA
Airport Service	NA	NA	NA	NA	NA	NA
Recreational	NA	NA	NA	NA	NA	NA
Recreational Marine	NA	NA	NA	NA	NA	NA
Light Commercial	NA	NA	NA	NA	NA	NA
Industrial	NA	NA	NA	NA	NA	NA
Construction	NA	NA	NA	NA	NA	NA
Agricultural	NA	NA	NA	NA	NA	NA
Logging	NA	NA	NA	NA	NA	NA
Marine Vessels	NA	NA	NA	NA	NA	NA
Nonroad Engines and Vehicles	NA	NA	NA	NA	NA	NA
Highway Vehicles	NA	NA	NA	NA	NA	NA
Other Area and Point Sources	NA	NA	NA	NA	NA	NA
All Sources	NA	NA	NA	NA	NA	NA

Baltimore MSA Inventory B
Emission Inventory Summary - VOC, NOx, CO

	tpy			tpsd		tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	3,313	149	25,464	13	1	17
Airport Service	295	1,962	2,388	1	5	7
Recreational	617	10	1,093	1	0	9
Recreational Marine	2,216	351	8,349	13	2	2
Light Commercial	1,016	235	12,725	3	1	35
Industrial	548	1,321	8,079	2	4	22
Construction	1,146	8,785	5,913	5	37	10
Agricultural	429	2,065	1,750	2	9	1
Logging	51	8	156	0	0	0
Marine Vessels	1,623	5,970	30,332	4	16	83
Nonroad Engines and Vehicles	11,254	20,856	96,249	43	74	185
Highway Vehicles	ND	54,317	ND	200	164	1,328
Other Area and Point Sources	ND	59,976	34,462	226	164	226
All Sources	NA	135,149	NA	469	403	1,739

Baltimore MSA Inventory B
Emission Inventory Summary - VOC, NOx, CO
Percent of Total Inventory

	% total tpy			% total tpsd		% total tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	NA	0.11%	NA	2.72%	0.16%	0.96%
Airport Service	NA	1.45%	NA	0.17%	1.34%	0.38%
Recreational	NA	0.01%	NA	0.12%	0.00%	0.51%
Recreational Marine	NA	0.26%	NA	2.83%	0.54%	0.11%
Light Commercial	NA	0.17%	NA	0.60%	0.16%	2.01%
Industrial	NA	0.98%	NA	0.34%	0.90%	1.27%
Construction	NA	6.50%	NA	1.02%	9.09%	0.56%
Agricultural	NA	1.53%	NA	0.40%	2.25%	0.07%
Logging	NA	0.01%	NA	0.03%	0.01%	0.02%
Marine Vessels	NA	4.42%	NA	0.95%	4.06%	4.78%
Nonroad Engines and Vehicles	NA	15.43%	NA	9.18%	18.51%	10.66%
Highway Vehicles	NA	40.19%	NA	42.64%	40.67%	76.35%
Other Area and Point Sources	NA	44.38%	NA	48.18%	40.82%	12.99%
All Sources	NA	100.00%	NA	100.00%	100.00%	100.00%

Baltimore MSA Inventory B
Emission Inventory Summary - Air Toxics and SOx

Equipment Category	tpy					
	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
Lawn & Garden	47	30	87	35	616	28
Airport Service	142	10	9	4	6	130
Recreational	23	2	18	8	32	1
Recreational Marine	112	21	57	24	337	28
Light Commercial	30	13	28	11	156	28
Industrial	45	22	15	6	79	44
Construction	721	171	34	17	33	764
Agricultural	231	62	12	7	15	161
Logging	2	1	1	1	5	1
Marine Vessels	302	ND	ND	ND	ND	1,719
Nonroad Engines and Vehicles	1,655	332	261	114	1,278	2,902
Highway Vehicles	ND	ND	ND	ND	ND	ND
Other Area and Point Sources	ND	ND	ND	ND	ND	ND
All Sources	NA	NA	NA	NA	NA	NA

Baltimore MSA Inventory B
Emission Inventory Summary - Air Toxics and SOx
Percent of Total Inventory

Equipment Category	% total tpy					
	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
Lawn & Garden	NA	NA	NA	NA	NA	NA
Airport Service	NA	NA	NA	NA	NA	NA
Recreational	NA	NA	NA	NA	NA	NA
Recreational Marine	NA	NA	NA	NA	NA	NA
Light Commercial	NA	NA	NA	NA	NA	NA
Industrial	NA	NA	NA	NA	NA	NA
Construction	NA	NA	NA	NA	NA	NA
Agricultural	NA	NA	NA	NA	NA	NA
Logging	NA	NA	NA	NA	NA	NA
Marine Vessels	NA	NA	NA	NA	NA	NA
Nonroad Engines and Vehicles	NA	NA	NA	NA	NA	NA
Highway Vehicles	NA	NA	NA	NA	NA	NA
Other Area and Point Sources	NA	NA	NA	NA	NA	NA
All Sources	NA	NA	NA	NA	NA	NA

Baton Rouge CMSA Inventory B
Emission Inventory Summary - VOC, NOx, CO

	tpy			tpsd		tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	1,094	66	11,012	4	0	8
Airport Service	227	1,510	1,833	1	4	5
Recreational	198	5	615	1	0	1
Recreational Marine	1,166	41	2,325	6	0	2
Light Commercial	513	129	6,698	1	0	18
Industrial	135	331	1,962	0	1	5
Construction	444	2,599	2,610	2	9	6
Agricultural	109	520	492	0	2	0
Logging	15	95	76	0	0	0
Marine Vessels	108	1,849	394	0	5	1
Nonroad Engines and Vehicles	4,009	7,145	28,016	16	23	46
Highway Vehicles	ND	14,555	ND	64	44	ND
Other Area and Point Sources	ND	82,744	ND	270	227	ND
All Sources	NA	104,444	NA	350	293	NA

Baton Rouge CMSA Inventory B
Emission Inventory Summary - VOC, NOx, CO
Percent of Total Inventory

	% total tpy			% total tpsd		% total tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	NA	0.06%	NA	1.16%	0.08%	NA
Airport Service	NA	1.45%	NA	0.18%	1.41%	NA
Recreational	NA	0.00%	NA	0.23%	0.01%	NA
Recreational Marine	NA	0.04%	NA	1.73%	0.07%	NA
Light Commercial	NA	0.12%	NA	0.41%	0.12%	NA
Industrial	NA	0.32%	NA	0.11%	0.31%	NA
Construction	NA	2.49%	NA	0.46%	3.21%	NA
Agricultural	NA	0.50%	NA	0.12%	0.66%	NA
Logging	NA	0.09%	NA	0.01%	0.09%	NA
Marine Vessels	NA	1.77%	NA	0.08%	1.73%	NA
Nonroad Engines and Vehicles	NA	6.84%	NA	4.49%	7.69%	NA
Highway Vehicles	NA	13.94%	NA	18.30%	14.97%	NA
Other Area and Point Sources	NA	79.22%	NA	77.21%	77.34%	NA
All Sources	NA	100.00%	NA	100.00%	100.00%	NA

Baton Rouge CMSA Inventory B
Emission Inventory Summary - Air Toxics and SOx

Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
			tpy			
Lawn & Garden	16	11	27	11	254	12
Airport Service	109	8	7	3	4	100
Recreational	2	1	5	2	25	0
Recreational Marine	70	5	32	14	94	6
Light Commercial	15	7	14	6	84	15
Industrial	12	6	4	2	19	12
Construction	223	51	13	6	24	226
Agricultural	58	16	3	2	3	41
Logging	8	2	0	0	1	8
Marine Vessels	109	ND	ND	ND	ND	739
Nonroad Engines and Vehicles	624	106	106	46	508	1,159
Highway Vehicles	ND	ND	ND	ND	ND	ND
Other Area and Point Sources	ND	ND	ND	ND	ND	ND
All Sources	NA	NA	NA	NA	NA	NA

Baton Rouge CMSA Inventory B
Emission Inventory Summary - Air Toxics and SOx
Percent of Total Inventory

Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
			% total tpy			
Lawn & Garden	NA	NA	NA	NA	NA	NA
Airport Service	NA	NA	NA	NA	NA	NA
Recreational	NA	NA	NA	NA	NA	NA
Recreational Marine	NA	NA	NA	NA	NA	NA
Light Commercial	NA	NA	NA	NA	NA	NA
Industrial	NA	NA	NA	NA	NA	NA
Construction	NA	NA	NA	NA	NA	NA
Agricultural	NA	NA	NA	NA	NA	NA
Logging	NA	NA	NA	NA	NA	NA
Marine Vessels	NA	NA	NA	NA	NA	NA
Nonroad Engines and Vehicles	NA	NA	NA	NA	NA	NA
Highway Vehicles	NA	NA	NA	NA	NA	NA
Other Area and Point Sources	NA	NA	NA	NA	NA	NA
All Sources	NA	NA	NA	NA	NA	NA

Boston CMSA Inventory B
Emission Inventory Summary - VOC, NOx, CO

Equipment Category	tpy VOC	tpy NOx	tpy CO	tpsd VOC	tpsd NOx	tpwd CO
Lawn & Garden	4,377	184	31,832	22	1	11
Airport Service	375	2,496	3,036	1	7	8
Recreational	2,203	35	3,769	2	0	32
Recreational Marine	6,913	1,059	31,237	48	8	3
Light Commercial	2,427	519	29,277	7	1	80
Industrial	1,029	2,690	14,782	3	7	40
Construction	2,606	19,407	13,084	12	91	14
Agricultural	156	596	1,000	1	3	1
Logging	56	133	200	0	0	1
Marine Vessels	ND	ND	ND	0	5	1
Nonroad Engines and Vehicles	20,144	27,120	128,218	97	125	191
Highway Vehicles	ND	ND	ND	415	207	1,470
Other Area and Point Sources	ND	ND	ND	304	169	599
All Sources	NA	NA	NA	816	500	2,260

Boston CMSA Inventory B
Emission Inventory Summary - VOC, NOx, CO
Percent of Total Inventory

Equipment Category	% total tpy VOC	% total tpy NOx	% total tpy CO	% total tpsd VOC	% total tpsd NOx	% total tpwd CO
Lawn & Garden	NA	NA	NA	2.76%	0.20%	0.47%
Airport Service	NA	NA	NA	0.13%	1.37%	0.37%
Recreational	NA	NA	NA	0.22%	0.01%	1.43%
Recreational Marine	NA	NA	NA	5.92%	1.58%	0.15%
Light Commercial	NA	NA	NA	0.83%	0.28%	3.55%
Industrial	NA	NA	NA	0.36%	1.47%	1.79%
Construction	NA	NA	NA	1.50%	18.28%	0.63%
Agricultural	NA	NA	NA	0.10%	0.65%	0.03%
Logging	NA	NA	NA	0.02%	0.07%	0.02%
Marine Vessels	NA	NA	NA	0.03%	0.99%	0.03%
Nonroad Engines and Vehicles	NA	NA	NA	11.87%	24.91%	8.47%
Highway Vehicles	NA	NA	NA	50.83%	41.37%	65.04%
Other Area and Point Sources	NA	NA	NA	37.30%	33.71%	26.48%
All Sources	NA	NA	NA	100.00%	100.00%	100.00%

Boston CMSA Inventory B
Emission Inventory Summary - Air Toxics and SOx

Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
				tpy		
Lawn & Garden	68	40	112	45	905	34
Airport Service	181	13	11	6	8	165
Recreational	83	8	63	27	116	3
Recreational Marine	307	77	174	74	1,198	82
Light Commercial	72	30	67	27	351	62
Industrial	116	46	28	12	131	112
Construction	1,676	360	77	41	44	1,683
Agricultural	64	18	4	2	18	46
Logging	12	3	2	1	5	11
Marine Vessels	173	ND	ND	ND	ND	ND
Nonroad Engines and Vehicles	2,753	595	538	235	2,775	2,199
Highway Vehicles	ND	ND	ND	ND	ND	ND
Other Area and Point Sources	ND	ND	ND	ND	ND	ND
All Sources	NA	NA	NA	NA	NA	NA

Boston CMSA Inventory B
Emission Inventory Summary - Air Toxics and SOx
Percent of Total Inventory

Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
				% total tpy		
Lawn & Garden	NA	NA	NA	NA	NA	NA
Airport Service	NA	NA	NA	NA	NA	NA
Recreational	NA	NA	NA	NA	NA	NA
Recreational Marine	NA	NA	NA	NA	NA	NA
Light Commercial	NA	NA	NA	NA	NA	NA
Industrial	NA	NA	NA	NA	NA	NA
Construction	NA	NA	NA	NA	NA	NA
Agricultural	NA	NA	NA	NA	NA	NA
Logging	NA	NA	NA	NA	NA	NA
Marine Vessels	NA	NA	NA	NA	NA	NA
Nonroad Engines and Vehicles	NA	NA	NA	NA	NA	NA
Highway Vehicles	NA	NA	NA	NA	NA	NA
Other Area and Point Sources	NA	NA	NA	NA	NA	NA
All Sources	NA	NA	NA	NA	NA	NA

Chicago CMSA Inventory B
Emission Inventory Summary - VOC, NOx, CO

	tpy			tpsd		tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	7,579	300	52,394	39	2	20
Airport Service	761	5,063	6,153	2	14	17
Recreational	3,350	53	5,638	3	0	49
Recreational Marine	2,432	205	5,940	17	2	0
Light Commercial	4,099	876	49,400	11	2	135
Industrial	2,214	5,608	32,387	6	15	89
Construction	2,021	13,567	11,167	10	64	12
Agricultural	730	3,506	2,941	4	19	2
Logging	69	1	208	0	0	1
Marine Vessels	ND	608	ND	1	26	ND
Nonroad Engines and Vehicles	23,255	29,789	166,226	93	144	324
Highway Vehicles	ND	153,215	ND	588	462	ND
Other Area and Point Sources	ND	302,107	ND	1,029	603	ND
All Sources	NA	485,111	NA	1,710	1,209	NA

Chicago CMSA Inventory B
Emission Inventory Summary - VOC, NOx, CO
Percent of Total Inventory

	% total tpy			% total tpsd		% total tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	NA	0.06%	NA	2.28%	0.13%	NA
Airport Service	NA	1.04%	NA	0.12%	1.15%	NA
Recreational	NA	0.01%	NA	0.16%	0.00%	NA
Recreational Marine	NA	0.04%	NA	1.00%	0.13%	NA
Light Commercial	NA	0.18%	NA	0.67%	0.20%	NA
Industrial	NA	1.16%	NA	0.37%	1.27%	NA
Construction	NA	2.80%	NA	0.56%	5.29%	NA
Agricultural	NA	0.72%	NA	0.23%	1.59%	NA
Logging	NA	0.00%	NA	0.01%	0.00%	NA
Marine Vessels	NA	0.13%	NA	0.07%	2.19%	NA
Nonroad Engines and Vehicles	NA	6.14%	NA	5.46%	11.95%	NA
Highway Vehicles	NA	31.58%	NA	34.37%	38.18%	NA
Other Area and Point Sources	NA	62.28%	NA	60.17%	49.87%	NA
All Sources	NA	100.00%	NA	100.00%	100.00%	NA

Chicago CMSA Inventory B
Emission Inventory Summary - Air Toxics and SOx

Equipment Category	PM	Aldehydes	Benzene	tpy 1,3 But.	Gas. Vap.	SOx
Lawn & Garden	124	70	197	80	1,432	56
Airport Service	366	26	23	11	16	335
Recreational	128	13	96	41	174	5
Recreational Marine	124	15	59	25	491	19
Light Commercial	122	51	114	46	596	105
Industrial	232	96	60	26	284	227
Construction	1,168	267	59	30	85	1,180
Agricultural	390	105	21	11	30	274
Logging	2	1	2	1	7	0
Marine Vessels	300	ND	ND	ND	ND	ND
Nonroad Engines and Vehicles	2,956	643	630	272	3,115	2,201
Highway Vehicles	113,525	ND	ND	ND	ND	ND
Other Area and Point Sources	181,246	ND	ND	ND	ND	ND
All Sources	297,727	NA	NA	NA	NA	NA

Chicago CMSA Inventory B
Emission Inventory Summary - Air Toxics and SOx
Percent of Total Inventory

Equipment Category	PM	Aldehydes	Benzene	% total tpy 1,3 But.	Gas. Vap.	SOx
Lawn & Garden	0.04%	NA	NA	NA	NA	NA
Airport Service	0.12%	NA	NA	NA	NA	NA
Recreational	0.04%	NA	NA	NA	NA	NA
Recreational Marine	0.04%	NA	NA	NA	NA	NA
Light Commercial	0.04%	NA	NA	NA	NA	NA
Industrial	0.08%	NA	NA	NA	NA	NA
Construction	0.39%	NA	NA	NA	NA	NA
Agricultural	0.13%	NA	NA	NA	NA	NA
Logging	0.00%	NA	NA	NA	NA	NA
Marine Vessels	0.10%	NA	NA	NA	NA	NA
Nonroad Engines and Vehicles	0.99%	NA	NA	NA	NA	NA
Highway Vehicles	38.13%	NA	NA	NA	NA	NA
Other Area and Point Sources	60.88%	NA	NA	NA	NA	NA
All Sources	100.00%	NA	NA	NA	NA	NA

Cleveland CMSA Inventory B
Emission Inventory Summary - VOC, NOx, CO

	tpy			tpsd		tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	4,098	163	29,523	21	1	7
Airport Service	323	2,151	2,608	1	6	7
Recreational	507	8	854	0	0	7
Recreational Marine	1,050	111	3,147	7	1	0
Light Commercial	1,643	351	19,802	5	1	54
Industrial	954	2,470	13,755	3	7	38
Construction	733	5,169	3,989	3	24	4
Agricultural	338	1,576	1,371	2	9	1
Logging	27	8	84	0	0	0
Marine Vessels	1,003	109	3,757	3	0	ND
Nonroad Engines and Vehicles	10,676	12,117	78,890	45	49	119
Highway Vehicles	ND	64,808	412,340	242	195	2,360
Other Area and Point Sources	ND	62,301	88,401	369	171	252
All Sources	NA	139,226	579,631	656	415	2,731

Cleveland CMSA Inventory B
Emission Inventory Summary - VOC, NOx, CO
Percent of Total Inventory

	% total tpy			% total tpsd		% total tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	NA	0.12%	5.09%	3.25%	0.21%	0.27%
Airport Service	NA	1.54%	0.45%	0.14%	1.42%	0.26%
Recreational	NA	0.01%	0.15%	0.06%	0.00%	0.27%
Recreational Marine	NA	0.08%	0.54%	1.11%	0.21%	0.00%
Light Commercial	NA	0.25%	3.42%	0.70%	0.23%	1.99%
Industrial	NA	1.77%	2.37%	0.42%	1.63%	1.38%
Construction	NA	3.71%	0.69%	0.53%	5.87%	0.16%
Agricultural	NA	1.13%	0.24%	0.28%	2.08%	0.03%
Logging	NA	0.01%	0.01%	0.01%	0.01%	0.01%
Marine Vessels	NA	0.08%	0.65%	0.42%	0.07%	0.00%
Nonroad Engines and Vehicles	NA	8.70%	13.61%	6.90%	11.74%	4.37%
Highway Vehicles	NA	46.55%	71.14%	36.86%	47.10%	86.41%
Other Area and Point Sources	NA	44.75%	15.25%	56.24%	41.16%	9.21%
All Sources	NA	100.00%	100.00%	100.00%	100.00%	100.00%

Cleveland CMSA Inventory B
Emission Inventory Summary - Air Toxics and SOx

	tpy					
Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
Lawn & Garden	68	39	105	42	854	31
Airport Service	156	11	10	5	7	142
Recreational	19	2	15	6	26	1
Recreational Marine	48	8	24	10	252	9
Light Commercial	49	20	46	18	239	42
Industrial	105	42	26	11	123	102
Construction	435	101	21	11	29	449
Agricultural	176	47	10	5	16	123
Logging	1	0	1	0	3	1
Marine Vessels	ND	ND	ND	ND	ND	ND
Nonroad Engines and Vehicles	1,057	270	256	110	1,549	899
Highway Vehicles	46,729	ND	ND	ND	ND	ND
Other Area and Point Sources	64,287	ND	ND	ND	ND	ND
All Sources	112,073	NA	NA	NA	NA	NA

Cleveland CMSA Inventory B
Emission Inventory Summary - Air Toxics and SOx
Percent of Total Inventory

	% total tpy					
Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
Lawn & Garden	0.06%	NA	NA	NA	NA	NA
Airport Service	0.14%	NA	NA	NA	NA	NA
Recreational	0.02%	NA	NA	NA	NA	NA
Recreational Marine	0.04%	NA	NA	NA	NA	NA
Light Commercial	0.04%	NA	NA	NA	NA	NA
Industrial	0.09%	NA	NA	NA	NA	NA
Construction	0.39%	NA	NA	NA	NA	NA
Agricultural	0.16%	NA	NA	NA	NA	NA
Logging	0.00%	NA	NA	NA	NA	NA
Marine Vessels	0.00%	NA	NA	NA	NA	NA
Nonroad Engines and Vehicles	0.94%	NA	NA	NA	NA	NA
Highway Vehicles	41.70%	NA	NA	NA	NA	NA
Other Area and Point Sources	57.36%	NA	NA	NA	NA	NA
All Sources	100.00%	NA	NA	NA	NA	NA

Denver CMSA Inventory B
Emission Inventory Summary - VOC, NOx, CO

Equipment Category	tpy			tpsd		tpwd
	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	2,490	170	23,512	13	1	7
Airport Service	239	1,591	1,931	1	4	5
Recreational	1,480	24	2,542	1	0	21
Recreational Marine	765	82	2,298	5	1	0
Light Commercial	2,010	465	25,138	6	1	69
Industrial	445	1,182	6,209	1	3	17
Construction	896	5,689	5,032	4	27	6
Agricultural	208	1,020	796	1	6	1
Logging	19	1	58	0	0	0
Marine Vessels	ND	ND	0	ND	ND	0
Nonroad Engines and Vehicles	8,553	10,225	67,515	32	43	126
Highway Vehicles	ND	ND	417,406	ND	ND	2,371
Other Area and Point Sources	ND	ND	58,870	ND	ND	168
All Sources	NA	NA	543,791	NA	NA	2,665

Denver CMSA Inventory B
Emission Inventory Summary - VOC, NOx, CO
Percent of Total Inventory

Equipment Category	% total tpy			% total tpsd		% total tpwd
	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	NA	NA	4.32%	NA	NA	0.28%
Airport Service	NA	NA	0.36%	NA	NA	0.20%
Recreational	NA	NA	0.47%	NA	NA	0.80%
Recreational Marine	NA	NA	0.42%	NA	NA	0.00%
Light Commercial	NA	NA	4.62%	NA	NA	2.58%
Industrial	NA	NA	1.14%	NA	NA	0.64%
Construction	NA	NA	0.93%	NA	NA	0.21%
Agricultural	NA	NA	0.15%	NA	NA	0.02%
Logging	NA	NA	0.01%	NA	NA	0.01%
Marine Vessels	NA	NA	0.00%	NA	NA	0.00%
Nonroad Engines and Vehicles	NA	NA	12.42%	NA	NA	4.73%
Highway Vehicles	NA	NA	76.76%	NA	NA	88.98%
Other Area and Point Sources	NA	NA	10.83%	NA	NA	6.29%
All Sources	NA	NA	100.00%	NA	NA	100.00%

Denver CMSA Inventory B
Emission Inventory Summary - Air Toxics and SOx

				tpy		
Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
Lawn & Garden	39	26	63	25	537	29
Airport Service	115	8	7	4	5	105
Recreational	56	6	42	18	76	2
Recreational Marine	40	6	20	8	114	7
Light Commercial	60	25	56	22	310	55
Industrial	56	20	12	5	52	54
Construction	490	111	26	13	42	498
Agricultural	110	30	6	3	16	80
Logging	0	0	1	0	2	0
Marine Vessels	ND	ND	ND	ND	ND	ND
Nonroad Engines and Vehicles	967	232	232	100	1,154	830
Highway Vehicles	32,716	ND	ND	ND	ND	ND
Other Area and Point Sources	146,677	ND	ND	ND	ND	ND
All Sources	180,360	NA	NA	NA	NA	NA

Denver CMSA Inventory B
Emission Inventory Summary - Air Toxics and SOx
Percent of Total Inventory

				% total tpy		
Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
Lawn & Garden	0.02%	NA	NA	NA	NA	NA
Airport Service	0.06%	NA	NA	NA	NA	NA
Recreational	0.03%	NA	NA	NA	NA	NA
Recreational Marine	0.02%	NA	NA	NA	NA	NA
Light Commercial	0.03%	NA	NA	NA	NA	NA
Industrial	0.03%	NA	NA	NA	NA	NA
Construction	0.27%	NA	NA	NA	NA	NA
Agricultural	0.06%	NA	NA	NA	NA	NA
Logging	0.00%	NA	NA	NA	NA	NA
Marine Vessels	0.00%	NA	NA	NA	NA	NA
Nonroad Engines and Vehicles	0.54%	NA	NA	NA	NA	NA
Highway Vehicles	18.14%	NA	NA	NA	NA	NA
Other Area and Point Sources	81.32%	NA	NA	NA	NA	NA
All Sources	100.00%	NA	NA	NA	NA	NA

El Paso MSA Inventory B
Emission Inventory Summary - VOC, NOx, CO

Equipment Category	tpy VOC	tpy NOx	tpy CO	tpsd VOC	tpsd NOx	tpwd CO
Lawn & Garden	595	38	5,679	2	0	4
Airport Service	71	470	575	0	1	2
Recreational	178	4	548	1	0	1
Recreational Marine	0	0	0	0	0	0
Light Commercial	501	129	6,598	1	0	18
Industrial	212	537	2,997	1	1	8
Construction	258	1,730	1,444	1	6	3
Agricultural	46	205	232	0	1	0
Logging	3	4	9	0	0	0
Marine Vessels	0	0	0	0	0	0
Nonroad Engines and Vehicles	1,863	3,117	18,082	6	10	36
Highway Vehicles	ND	11,156	320,700	36	34	756
Other Area and Point Sources	ND	20,382	18,000	60	25	24
All Sources	NA	34,655	356,782	103	69	816

El Paso MSA Inventory B
Emission Inventory Summary - VOC, NOx, CO
Percent of Total Inventory

Equipment Category	% total tpy VOC	% total tpy NOx	% total tpy CO	% total tpsd VOC	% total tpsd NOx	% total tpwd CO
Lawn & Garden	NA	0.11%	1.59%	2.15%	0.21%	0.48%
Airport Service	NA	1.36%	0.16%	0.19%	1.87%	0.19%
Recreational	NA	0.01%	0.15%	0.71%	0.02%	0.09%
Recreational Marine	NA	0.00%	0.00%	0.00%	0.00%	0.00%
Light Commercial	NA	0.37%	1.85%	1.36%	0.51%	2.22%
Industrial	NA	1.55%	0.84%	0.59%	2.14%	1.01%
Construction	NA	4.99%	0.40%	0.91%	9.10%	0.39%
Agricultural	NA	0.59%	0.07%	0.17%	1.11%	0.02%
Logging	NA	0.01%	0.00%	0.01%	0.01%	0.00%
Marine Vessels	NA	0.00%	0.00%	0.00%	0.00%	0.00%
Nonroad Engines and Vehicles	NA	8.99%	5.07%	6.09%	14.97%	4.39%
Highway Vehicles	NA	32.19%	89.89%	35.40%	48.87%	92.63%
Other Area and Point Sources	NA	58.81%	5.05%	58.51%	36.15%	2.98%
All Sources	NA	100.00%	100.00%	100.00%	100.00%	100.00%

El Paso MSA Inventory B
Emission Inventory Summary - Air Toxics and SOx

Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
	tpy					
Lawn & Garden	10	6	15	6	116	7
Airport Service	34	2	2	1	1	31
Recreational	2	1	5	2	23	0
Recreational Marine	0	0	0	0	0	0
Light Commercial	15	6	14	6	81	15
Industrial	22	9	6	2	27	21
Construction	145	36	8	4	12	154
Agricultural	22	6	1	1	3	16
Logging	0	0	0	0	0	0
Marine Vessels	0	0	ND	ND	ND	0
Nonroad Engines and Vehicles	251	67	51	22	262	245
Highway Vehicles	7,278	ND	ND	ND	ND	ND
Other Area and Point Sources	129,939	ND	ND	ND	ND	ND
All Sources	137,468	NA	NA	NA	NA	NA

El Paso MSA Inventory B
Emission Inventory Summary - Air Toxics and SOx
Percent of Total Inventory

Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
	% total tpy					
Lawn & Garden	0.01%	NA	NA	NA	NA	NA
Airport Service	0.02%	NA	NA	NA	NA	NA
Recreational	0.00%	NA	NA	NA	NA	NA
Recreational Marine	0.00%	NA	NA	NA	NA	NA
Light Commercial	0.01%	NA	NA	NA	NA	NA
Industrial	0.02%	NA	NA	NA	NA	NA
Construction	0.11%	NA	NA	NA	NA	NA
Agricultural	0.02%	NA	NA	NA	NA	NA
Logging	0.00%	NA	NA	NA	NA	NA
Marine Vessels	0.00%	NA	NA	NA	NA	NA
Nonroad Engines and Vehicles	0.18%	NA	NA	NA	NA	NA
Highway Vehicles	5.29%	NA	NA	NA	NA	NA
Other Area and Point Sources	94.52%	NA	NA	NA	NA	NA
All Sources	100.00%	NA	NA	NA	NA	NA

Hartford NECMA Inventory B
Emission Inventory Summary - VOC, NOx, CO

	tpy			tpsd		tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	2,435	77	14,964	13	0	4
Airport Service	270	1,800	2,188	1	5	6
Recreational	951	15	1,629	1	0	14
Recreational Marine	1,779	147	5,214	13	1	1
Light Commercial	594	127	7,165	2	0	20
Industrial	320	860	4,525	1	2	12
Construction	856	7,529	4,447	4	35	5
Agricultural	115	490	624	1	3	0
Logging	33	33	106	0	0	0
Marine Vessels	11	260	29	0	1	0
Nonroad Engines and Vehicles	7,363	11,339	40,890	34	48	62
Highway Vehicles	ND	29,311	108,380	189	88	590
Other Area and Point Sources	ND	11,650	51,997	77	18	210
All Sources	NA	52,300	201,267	300	155	862

Hartford NECMA Inventory B
Emission Inventory Summary - VOC, NOx, CO
Percent of Total Inventory

	% total tpy			% total tpsd		% total tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	NA	0.15%	7.43%	4.27%	0.27%	0.41%
Airport Service	NA	3.44%	1.09%	0.25%	3.19%	0.70%
Recreational	NA	0.03%	0.81%	0.26%	0.01%	1.62%
Recreational Marine	NA	0.28%	2.59%	4.23%	0.71%	0.07%
Light Commercial	NA	0.24%	3.56%	0.55%	0.23%	2.28%
Industrial	NA	1.64%	2.25%	0.30%	1.52%	1.44%
Construction	NA	14.39%	2.21%	1.35%	22.96%	0.57%
Agricultural	NA	0.94%	0.31%	0.21%	1.74%	0.05%
Logging	NA	0.06%	0.05%	0.03%	0.06%	0.03%
Marine Vessels	NA	0.50%	0.01%	0.01%	0.46%	0.01%
Nonroad Engines and Vehicles	NA	21.68%	20.32%	11.45%	31.14%	7.16%
Highway Vehicles	NA	56.04%	53.85%	62.91%	57.16%	68.47%
Other Area and Point Sources	NA	22.28%	25.83%	25.65%	11.70%	24.37%
All Sources	NA	100.00%	100.00%	100.00%	100.00%	100.00%

Hartford NECMA Inventory B
Emission Inventory Summary - Air Toxics and SOx

	tpy					
Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
Lawn & Garden	40	21	64	26	455	15
Airport Service	130	9	8	4	6	119
Recreational	36	4	27	12	50	1
Recreational Marine	95	13	47	20	227	14
Light Commercial	18	7	17	7	86	15
Industrial	41	15	9	4	38	39
Construction	627	138	25	13	16	640
Agricultural	54	15	3	2	8	38
Logging	3	1	1	0	3	3
Marine Vessels	ND	ND	ND	ND	ND	ND
Nonroad Engines and Vehicles	1,044	223	201	88	889	885
Highway Vehicles	ND	ND	ND	ND	ND	ND
Other Area and Point Sources	ND	ND	ND	ND	ND	ND
All Sources	NA	NA	NA	NA	NA	NA

Hartford NECMA Inventory B
Emission Inventory Summary - Air Toxics and SOx
Percent of Total Inventory

	% total tpy					
Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
Lawn & Garden	NA	NA	NA	NA	NA	NA
Airport Service	NA	NA	NA	NA	NA	NA
Recreational	NA	NA	NA	NA	NA	NA
Recreational Marine	NA	NA	NA	NA	NA	NA
Light Commercial	NA	NA	NA	NA	NA	NA
Industrial	NA	NA	NA	NA	NA	NA
Construction	NA	NA	NA	NA	NA	NA
Agricultural	NA	NA	NA	NA	NA	NA
Logging	NA	NA	NA	NA	NA	NA
Marine Vessels	NA	NA	NA	NA	NA	NA
Nonroad Engines and Vehicles	NA	NA	NA	NA	NA	NA
Highway Vehicles	NA	NA	NA	NA	NA	NA
Other Area and Point Sources	NA	NA	NA	NA	NA	NA
All Sources	NA	NA	NA	NA	NA	NA

Houston CMSA Inventory B
Emission Inventory Summary - VOC, NOx, CO

	tpy			tpsd		tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	6,523	334	55,672	24	1	41
Airport Service	411	2,739	3,331	1	8	9
Recreational	579	13	1,778	2	0	2
Recreational Marine	11,387	441	26,260	60	2	20
Light Commercial	4,518	1,166	59,504	13	3	163
Industrial	1,143	2,833	16,449	3	8	45
Construction	2,606	15,852	15,198	9	57	33
Agricultural	650	3,237	2,623	2	12	2
Logging	69	188	271	0	1	1
Marine Vessels	688	12,462	1,718	2	34	5
Nonroad Engines and Vehicles	28,575	39,265	182,801	116	126	321
Highway Vehicles	ND	100,865	ND	442	304	ND
Other Area and Point Sources	ND	440,925	ND	1,391	859	ND
All Sources	NA	581,055	NA	1,950	1,289	NA

Houston CMSA Inventory B
Emission Inventory Summary - VOC, NOx, CO
Percent of Total Inventory

	% total tpy			% total tpsd		% total tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	NA	0.06%	NA	1.21%	0.10%	NA
Airport Service	NA	0.47%	NA	0.06%	0.58%	NA
Recreational	NA	0.00%	NA	0.12%	0.00%	NA
Recreational Marine	NA	0.08%	NA	3.05%	0.18%	NA
Light Commercial	NA	0.20%	NA	0.64%	0.25%	NA
Industrial	NA	0.49%	NA	0.17%	0.60%	NA
Construction	NA	2.73%	NA	0.48%	4.45%	NA
Agricultural	NA	0.56%	NA	0.12%	0.94%	NA
Logging	NA	0.03%	NA	0.01%	0.04%	NA
Marine Vessels	NA	2.14%	NA	0.10%	2.65%	NA
Nonroad Engines and Vehicles	NA	6.76%	NA	5.97%	9.78%	NA
Highway Vehicles	NA	17.36%	NA	22.69%	23.57%	NA
Other Area and Point Sources	NA	75.88%	NA	71.34%	66.65%	NA
All Sources	NA	100.00%	NA	100.00%	100.00%	NA

Houston CMSA Inventory B
Emission Inventory Summary - Air Toxics and SOx

Equipment Category	PM	Aldehydes	Benzene	tpy 1,3 But.	Gas. Vap.	SOx
Lawn & Garden	108	67	174	70	1,106	61
Airport Service	198	14	12	6	8	181
Recreational	6	3	15	7	75	1
Recreational Marine	690	61	326	140	624	62
Light Commercial	137	58	124	50	729	138
Industrial	110	48	31	13	151	107
Construction	1,351	314	76	38	134	1,380
Agricultural	359	97	19	10	18	253
Logging	17	4	2	1	6	16
Marine Vessels	741	ND	ND	ND	ND	5,152
Nonroad Engines and Vehicles	3,717	666	780	335	2,850	7,350
Highway Vehicles	ND	ND	ND	ND	ND	ND
Other Area and Point Sources	ND	ND	ND	ND	ND	ND
All Sources	NA	NA	NA	NA	NA	NA

Houston CMSA Inventory B
Emission Inventory Summary - Air Toxics and SOx
Percent of Total Inventory

Equipment Category	PM	Aldehydes	Benzene	% total tpy 1,3 But.	Gas. Vap.	SOx
Lawn & Garden	NA	NA	NA	NA	NA	NA
Airport Service	NA	NA	NA	NA	NA	NA
Recreational	NA	NA	NA	NA	NA	NA
Recreational Marine	NA	NA	NA	NA	NA	NA
Light Commercial	NA	NA	NA	NA	NA	NA
Industrial	NA	NA	NA	NA	NA	NA
Construction	NA	NA	NA	NA	NA	NA
Agricultural	NA	NA	NA	NA	NA	NA
Logging	NA	NA	NA	NA	NA	NA
Marine Vessels	NA	NA	NA	NA	NA	NA
Nonroad Engines and Vehicles	NA	NA	NA	NA	NA	NA
Highway Vehicles	NA	NA	NA	NA	NA	NA
Other Area and Point Sources	NA	NA	NA	NA	NA	NA
All Sources	NA	NA	NA	NA	NA	NA

Miami CMSA Inventory B
Emission Inventory Summary - VOC, NOx, CO

	tpy			tpsd		tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	3,612	244	35,678	13	1	25
Airport Service	186	1,239	1,501	1	3	4
Recreational	405	9	1,255	2	0	2
Recreational Marine	2,598	212	6,710	13	1	5
Light Commercial	1,497	376	19,562	4	1	54
Industrial	807	1,941	11,826	2	5	32
Construction	1,297	10,164	6,938	5	37	15
Agricultural	192	819	1,075	1	3	1
Logging	14	0	43	0	0	0
Marine Vessels	943	1,310	ND	3	4	ND
Nonroad Engines and Vehicles	11,552	16,314	84,590	43	55	138
Highway Vehicles	ND	63,266	ND	307	191	ND
Other Area and Point Sources	ND	35,464	ND	235	97	ND
All Sources	NA	115,044	NA	585	343	NA

Miami CMSA Inventory B
Emission Inventory Summary - VOC, NOx, CO
Percent of Total Inventory

	% total tpy			% total tpsd		% total tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	NA	0.21%	NA	2.29%	0.26%	NA
Airport Service	NA	1.08%	NA	0.09%	0.99%	NA
Recreational	NA	0.01%	NA	0.27%	0.01%	NA
Recreational Marine	NA	0.18%	NA	2.27%	0.33%	NA
Light Commercial	NA	0.33%	NA	0.71%	0.30%	NA
Industrial	NA	1.69%	NA	0.40%	1.55%	NA
Construction	NA	8.84%	NA	0.80%	10.72%	NA
Agricultural	NA	0.71%	NA	0.12%	0.89%	NA
Logging	NA	0.00%	NA	0.01%	0.00%	NA
Marine Vessels	NA	1.14%	NA	0.44%	1.05%	NA
Nonroad Engines and Vehicles	NA	14.18%	NA	7.40%	16.09%	NA
Highway Vehicles	NA	54.99%	NA	52.44%	55.58%	NA
Other Area and Point Sources	NA	30.83%	NA	40.17%	28.32%	NA
All Sources	NA	100.00%	NA	100.00%	100.00%	NA

Miami CMSA Inventory B
Emission Inventory Summary - Air Toxics and SOx

Equipment Category	PM	Aldehydes	Benzene	tpy 1,3 But.	Gas. Vap.	SOx
Lawn & Garden	61	40	95	38	682	42
Airport Service	90	6	6	3	4	82
Recreational	4	2	11	5	52	1
Recreational Marine	132	16	64	27	497	20
Light Commercial	45	19	41	16	246	44
Industrial	67	33	22	9	114	66
Construction	838	203	38	20	41	888
Agricultural	90	25	5	3	15	64
Logging	0	0	0	0	2	0
Marine Vessels	ND	ND	ND	ND	ND	ND
Nonroad Engines and Vehicles	1,327	344	281	121	1,651	1,207
Highway Vehicles	ND	ND	ND	ND	ND	ND
Other Area and Point Sources	ND	ND	ND	ND	ND	ND
All Sources	NA	NA	NA	NA	NA	NA

Miami CMSA Inventory B
Emission Inventory Summary - Air Toxics and SOx
Percent of Total Inventory

Equipment Category	PM	Aldehydes	Benzene	% total tpy 1,3 But.	Gas. Vap.	SOx
Lawn & Garden	NA	NA	NA	NA	NA	NA
Airport Service	NA	NA	NA	NA	NA	NA
Recreational	NA	NA	NA	NA	NA	NA
Recreational Marine	NA	NA	NA	NA	NA	NA
Light Commercial	NA	NA	NA	NA	NA	NA
Industrial	NA	NA	NA	NA	NA	NA
Construction	NA	NA	NA	NA	NA	NA
Agricultural	NA	NA	NA	NA	NA	NA
Logging	NA	NA	NA	NA	NA	NA
Marine Vessels	NA	NA	NA	NA	NA	NA
Nonroad Engines and Vehicles	NA	NA	NA	NA	NA	NA
Highway Vehicles	NA	NA	NA	NA	NA	NA
Other Area and Point Sources	NA	NA	NA	NA	NA	NA
All Sources	NA	NA	NA	NA	NA	NA

Milwaukee CMSA Inventory B
Emission Inventory Summary - VOC, NOx, CO

	tpy			tpsd		tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	2,317	97	17,330	12	1	4
Airport Service	178	1,182	1,435	0	3	4
Recreational	572	9	969	0	0	8
Recreational Marine	1,199	41	2,175	8	0	0
Light Commercial	733	157	8,832	2	0	24
Industrial	537	1,358	7,830	2	4	21
Construction	408	2,974	2,285	2	14	3
Agricultural	329	1,560	1,373	2	9	1
Logging	19	0	58	0	0	0
Marine Vessels	457	398	ND	1	1	ND
Nonroad Engines and Vehicles	6,748	7,776	42,286	30	32	65
Highway Vehicles	ND	33,493	ND	106	101	ND
Other Area and Point Sources	ND	39,621	ND	195	109	ND
All Sources	NA	80,890	NA	331	241	NA

Milwaukee CMSA Inventory B
Emission Inventory Summary - VOC, NOx, CO
Percent of Total Inventory

	% total tpy			% total tpsd		% total tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	NA	0.12%	NA	3.64%	0.22%	NA
Airport Service	NA	1.46%	NA	0.15%	1.34%	NA
Recreational	NA	0.01%	NA	0.13%	0.00%	NA
Recreational Marine	NA	0.05%	NA	2.54%	0.13%	NA
Light Commercial	NA	0.19%	NA	0.62%	0.18%	NA
Industrial	NA	1.68%	NA	0.47%	1.54%	NA
Construction	NA	3.68%	NA	0.58%	5.81%	NA
Agricultural	NA	1.93%	NA	0.54%	3.54%	NA
Logging	NA	0.00%	NA	0.02%	0.00%	NA
Marine Vessels	NA	0.49%	NA	0.38%	0.45%	NA
Nonroad Engines and Vehicles	NA	9.61%	NA	9.07%	13.21%	NA
Highway Vehicles	NA	41.41%	NA	31.96%	41.82%	NA
Other Area and Point Sources	NA	48.98%	NA	58.97%	44.97%	NA
All Sources	NA	100.00%	NA	100.00%	100.00%	NA

Milwaukee CMSA Inventory B
Emission Inventory Summary - Air Toxics and SOx

Equipment Category				tpy		
	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
Lawn & Garden	37	22	59	24	498	18
Airport Service	86	6	5	3	4	78
Recreational	22	2	16	7	30	1
Recreational Marine	61	5	29	12	256	6
Light Commercial	22	9	20	8	107	19
Industrial	54	23	14	6	72	52
Construction	259	58	12	6	15	258
Agricultural	175	47	10	5	9	122
Logging	0	0	1	0	2	0
Marine Vessels	ND	ND	ND	ND	ND	ND
Nonroad Engines and Vehicles	715	172	166	72	992	554
Highway Vehicles	ND	ND	ND	ND	ND	ND
Other Area and Point Sources	ND	ND	ND	ND	ND	ND
All Sources	NA	NA	NA	NA	NA	NA

Milwaukee CMSA Inventory B
Emission Inventory Summary - Air Toxics and SOx
Percent of Total Inventory

Equipment Category				% total tpy		
	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
Lawn & Garden	NA	NA	NA	NA	NA	NA
Airport Service	NA	NA	NA	NA	NA	NA
Recreational	NA	NA	NA	NA	NA	NA
Recreational Marine	NA	NA	NA	NA	NA	NA
Light Commercial	NA	NA	NA	NA	NA	NA
Industrial	NA	NA	NA	NA	NA	NA
Construction	NA	NA	NA	NA	NA	NA
Agricultural	NA	NA	NA	NA	NA	NA
Logging	NA	NA	NA	NA	NA	NA
Marine Vessels	NA	NA	NA	NA	NA	NA
Nonroad Engines and Vehicles	NA	NA	NA	NA	NA	NA
Highway Vehicles	NA	NA	NA	NA	NA	NA
Other Area and Point Sources	NA	NA	NA	NA	NA	NA
All Sources	NA	NA	NA	NA	NA	NA

Minneapolis MSA Inventory B
Emission Inventory Summary - VOC, NOx, CO

	tpy			tpsd		tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	3,435	143	25,418	18	1	6
Airport Service	274	1,825	2,219	1	5	6
Recreational	839	13	1,424	1	0	12
Recreational Marine	6,089	237	13,544	46	2	0
Light Commercial	1,345	288	16,208	4	1	44
Industrial	600	1,607	8,523	2	4	23
Construction	879	5,810	4,715	4	27	5
Agricultural	925	4,408	3,869	5	24	3
Logging	36	5	109	0	0	0
Marine Vessels	ND	ND	28	ND	ND	0
Nonroad Engines and Vehicles	14,424	14,336	76,057	80	64	100
Highway Vehicles	ND	ND	419,140	ND	ND	2,422
Other Area and Point Sources	ND	63,307	125,911	ND	173	357
All Sources	NA	NA	621,108	NA	NA	2,878

Minneapolis MSA Inventory B
Emission Inventory Summary - VOC, NOx, CO
Percent of Total Inventory

	% total tpy			% total tpsd		% total tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	NA	NA	4.09%	NA	NA	0.21%
Airport Service	NA	NA	0.36%	NA	NA	0.21%
Recreational	NA	NA	0.23%	NA	NA	0.42%
Recreational Marine	NA	NA	2.18%	NA	NA	0.00%
Light Commercial	NA	NA	2.61%	NA	NA	1.54%
Industrial	NA	NA	1.37%	NA	NA	0.81%
Construction	NA	NA	0.76%	NA	NA	0.18%
Agricultural	NA	NA	0.62%	NA	NA	0.09%
Logging	NA	NA	0.02%	NA	NA	0.01%
Marine Vessels	NA	NA	0.00%	NA	NA	0.00%
Nonroad Engines and Vehicles	NA	NA	12.25%	NA	NA	3.48%
Highway Vehicles	NA	NA	67.48%	NA	NA	84.13%
Other Area and Point Sources	NA	NA	20.27%	NA	NA	12.39%
All Sources	NA	NA	100.00%	NA	NA	100.00%

Minneapolis MSA Inventory B
Emission Inventory Summary - Air Toxics and SOx

				tpy		
Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
Lawn & Garden	53	32	87	35	739	27
Airport Service	132	9	8	4	6	121
Recreational	32	3	24	10	44	1
Recreational Marine	364	32	171	73	444	33
Light Commercial	40	17	37	15	195	34
Industrial	75	28	16	7	72	73
Construction	509	113	26	13	32	508
Agricultural	494	133	27	14	20	344
Logging	1	0	1	0	4	0
Marine Vessels	8	ND	ND	ND	ND	ND
Nonroad Engines and Vehicles	1,708	366	398	173	1,556	1,141
Highway Vehicles	42,282	ND	ND	ND	ND	ND
Other Area and Point Sources	214,398	ND	ND	ND	ND	ND
All Sources	258,388	NA	NA	NA	NA	NA

Minneapolis MSA Inventory B
Emission Inventory Summary - Air Toxics and SOx
Percent of Total Inventory

				% total tpy		
Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
Lawn & Garden	0.02%	NA	NA	NA	NA	NA
Airport Service	0.05%	NA	NA	NA	NA	NA
Recreational	0.01%	NA	NA	NA	NA	NA
Recreational Marine	0.14%	NA	NA	NA	NA	NA
Light Commercial	0.02%	NA	NA	NA	NA	NA
Industrial	0.03%	NA	NA	NA	NA	NA
Construction	0.20%	NA	NA	NA	NA	NA
Agricultural	0.19%	NA	NA	NA	NA	NA
Logging	0.00%	NA	NA	NA	NA	NA
Marine Vessels	0.00%	NA	NA	NA	NA	NA
Nonroad Engines and Vehicles	0.66%	NA	NA	NA	NA	NA
Highway Vehicles	16.36%	NA	NA	NA	NA	NA
Other Area and Point Sources	82.98%	NA	NA	NA	NA	NA
All Sources	100.00%	NA	NA	NA	NA	NA

New York NECMA Inventory B
Emission Inventory Summary - VOC, NOx, CO

Equipment Category	tpy VOC	tpy NOx	tpy CO	tpsd VOC	tpsd NOx	tpwd CO
Lawn & Garden	12,391	546	89,652	63	3	43
Airport Service	573	3,818	4,634	2	10	13
Recreational	4,110	66	7,044	3	0	60
Recreational Marine	13,389	1,429	41,293	91	11	5
Light Commercial	11,519	2,464	138,936	32	7	381
Industrial	4,212	10,809	61,373	12	30	168
Construction	4,665	32,185	25,301	22	152	28
Agricultural	758	2,974	4,761	4	16	3
Logging	148	64	459	0	0	1
Marine Vessels	789	12,991	2,458	2	36	7
Nonroad Engines and Vehicles	52,552	67,346	375,911	231	264	708
Highway Vehicles	ND	317,257	3,129,400	1,114	956	7,373
Other Area and Point Sources	ND	232,882	546,500	1,578	638	804
All Sources	NA	617,485	4,051,811	2,923	1,858	8,885

New York NECMA Inventory B
Emission Inventory Summary - VOC, NOx, CO
Percent of Total Inventory

Equipment Category	% total tpy VOC	% total tpy NOx	% total tpy CO	% total tpsd VOC	% total tpsd NOx	% total tpwd CO
Lawn & Garden	NA	0.09%	2.21%	2.14%	0.16%	0.49%
Airport Service	NA	0.62%	0.11%	0.05%	0.56%	0.14%
Recreational	NA	0.01%	0.17%	0.11%	0.00%	0.67%
Recreational Marine	NA	0.23%	1.02%	3.11%	0.57%	0.05%
Light Commercial	NA	0.40%	3.43%	1.09%	0.36%	4.28%
Industrial	NA	1.75%	1.51%	0.41%	1.59%	1.89%
Construction	NA	5.21%	0.62%	0.75%	8.16%	0.31%
Agricultural	NA	0.48%	0.12%	0.14%	0.88%	0.04%
Logging	NA	0.01%	0.01%	0.01%	0.01%	0.01%
Marine Vessels	NA	2.10%	0.06%	0.07%	1.92%	0.08%
Nonroad Engines and Vehicles	NA	10.91%	9.28%	7.90%	14.22%	7.97%
Highway Vehicles	NA	51.38%	77.23%	38.11%	51.45%	82.98%
Other Area and Point Sources	NA	37.71%	13.49%	53.99%	34.33%	9.05%
All Sources	NA	100.00%	100.00%	100.00%	100.00%	100.00%

New York NECMA Inventory B
Emission Inventory Summary - Air Toxics and SOx

Equipment Category	PM	Aldehydes	Benzene	tpy 1,3 But.	Gas. Vap.	SOx
Lawn & Garden	193	115	324	131	2,290	100
Airport Service	276	19	17	9	12	252
Recreational	155	16	118	51	216	6
Recreational Marine	614	102	311	134	3,129	121
Light Commercial	343	142	320	129	1,664	295
Industrial	471	186	115	50	516	459
Construction	2,706	633	136	70	195	2,788
Agricultural	322	90	20	10	83	231
Logging	8	2	4	2	15	6
Marine Vessels	620	ND	ND	ND	ND	4,240
Nonroad Engines and Vehicles	5,710	1,306	1,365	585	8,121	8,497
Highway Vehicles	232,769	ND	ND	ND	ND	ND
Other Area and Point Sources	119,873	ND	ND	ND	ND	ND
All Sources	358,352	NA	NA	NA	NA	NA

New York NECMA Inventory B
Emission Inventory Summary - Air Toxics and SOx
Percent of Total Inventory

Equipment Category	PM	Aldehydes	Benzene	% total tpy 1,3 But.	Gas. Vap.	SOx
Lawn & Garden	0.05%	NA	NA	NA	NA	NA
Airport Service	0.08%	NA	NA	NA	NA	NA
Recreational	0.04%	NA	NA	NA	NA	NA
Recreational Marine	0.17%	NA	NA	NA	NA	NA
Light Commercial	0.10%	NA	NA	NA	NA	NA
Industrial	0.13%	NA	NA	NA	NA	NA
Construction	0.76%	NA	NA	NA	NA	NA
Agricultural	0.09%	NA	NA	NA	NA	NA
Logging	0.00%	NA	NA	NA	NA	NA
Marine Vessels	0.17%	NA	NA	NA	NA	NA
Nonroad Engines and Vehicles	1.59%	NA	NA	NA	NA	NA
Highway Vehicles	64.96%	NA	NA	NA	NA	NA
Other Area and Point Sources	33.45%	NA	NA	NA	NA	NA
All Sources	100.00%	NA	NA	NA	NA	NA

Philedelphia MSA Inventory B
Emission Inventory Summary - VOC, NOx, CO

Equipment Category	tpy VOC	tpy NOx	tpy CO	tpsd VOC	tpsd NOx	tpwd CO
Lawn & Garden	7,935	392	65,719	32	2	41
Airport Service	291	1,936	2,352	1	5	6
Recreational	1,337	22	2,365	1	0	19
Recreational Marine	3,578	338	10,163	21	2	2
Light Commercial	2,874	664	36,004	8	2	99
Industrial	1,592	3,985	23,041	5	11	63
Construction	2,177	15,289	11,215	9	64	18
Agricultural	805	3,867	3,266	4	17	2
Logging	77	10	234	0	0	1
Marine Vessels	494	9,181	1,377	1	25	4
Nonroad Engines and Vehicles	21,158	35,685	155,736	81	128	255
Highway Vehicles	ND	123,720	568,888	432	373	ND
Other Area and Point Sources	ND	137,579	178,772	911	377	ND
All Sources	NA	296,984	903,396	1,424	877	NA

Philedelphia MSA Inventory B
Emission Inventory Summary - VOC, NOx, CO
Percent of Total Inventory

Equipment Category	% total tpy VOC	% total tpy NOx	% total tpy CO	% total tpsd VOC	% total tpsd NOx	% total tpwd CO
Lawn & Garden	NA	0.13%	7.27%	2.22%	0.19%	NA
Airport Service	NA	0.65%	0.26%	0.06%	0.60%	NA
Recreational	NA	0.01%	0.26%	0.08%	0.00%	NA
Recreational Marine	NA	0.11%	1.12%	1.48%	0.24%	NA
Light Commercial	NA	0.22%	3.99%	0.56%	0.21%	NA
Industrial	NA	1.34%	2.55%	0.32%	1.24%	NA
Construction	NA	5.15%	1.24%	0.64%	7.26%	NA
Agricultural	NA	1.30%	0.36%	0.25%	1.93%	NA
Logging	NA	0.00%	0.03%	0.01%	0.00%	NA
Marine Vessels	NA	3.09%	0.15%	0.10%	2.87%	NA
Nonroad Engines and Vehicles	NA	12.02%	17.24%	5.71%	14.55%	NA
Highway Vehicles	NA	41.66%	62.97%	30.31%	42.49%	NA
Other Area and Point Sources	NA	46.33%	19.79%	63.98%	42.96%	NA
All Sources	NA	100.00%	100.00%	100.00%	100.00%	NA

Philedelphia MSA Inventory B
Emission Inventory Summary - Air Toxics and SOx

Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
	tpy					
Lawn & Garden	119	77	202	82	1,666	71
Airport Service	140	10	9	4	6	128
Recreational	49	5	38	16	69	2
Recreational Marine	172	25	85	37	769	30
Light Commercial	86	36	79	32	441	79
Industrial	158	68	43	19	210	154
Construction	1,250	288	64	33	72	1,324
Agricultural	433	116	23	12	31	302
Logging	2	1	2	1	8	1
Marine Vessels	553	ND	ND	ND	ND	4,366
Nonroad Engines and Vehicles	2,962	626	546	236	3,272	6,458
Highway Vehicles	ND	ND	ND	ND	ND	ND
Other Area and Point Sources	ND	ND	ND	ND	ND	ND
All Sources	NA	NA	NA	NA	NA	NA

Philedelphia MSA Inventory B
Emission Inventory Summary - Air Toxics and SOx
Percent of Total Inventory

Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
	% total tpy					
Lawn & Garden	NA	NA	NA	NA	NA	NA
Airport Service	NA	NA	NA	NA	NA	NA
Recreational	NA	NA	NA	NA	NA	NA
Recreational Marine	NA	NA	NA	NA	NA	NA
Light Commercial	NA	NA	NA	NA	NA	NA
Industrial	NA	NA	NA	NA	NA	NA
Construction	NA	NA	NA	NA	NA	NA
Agricultural	NA	NA	NA	NA	NA	NA
Logging	NA	NA	NA	NA	NA	NA
Marine Vessels	NA	NA	NA	NA	NA	NA
Nonroad Engines and Vehicles	NA	NA	NA	NA	NA	NA
Highway Vehicles	NA	NA	NA	NA	NA	NA
Other Area and Point Sources	NA	NA	NA	NA	NA	NA
All Sources	NA	NA	NA	NA	NA	NA

Provo-Orem MSA Inventory B
Emission Inventory Summary - VOC, NOx, CO

Equipment Category	tpy VOC	tpy NOx	tpy CO	tpsd VOC	tpsd NOx	tpwd CO
Lawn & Garden	486	28	4,201	3	0	1
Airport Service	0	0	0	0	0	0
Recreational	309	5	530	0	0	4
Recreational Marine	86	12	229	1	0	0
Light Commercial	75	17	939	0	0	3
Industrial	28	76	386	0	0	1
Construction	73	588	396	0	3	0
Agricultural	101	478	405	1	3	0
Logging	3	0	10	0	0	0
Marine Vessels	ND	ND	315	ND	ND	1
Nonroad Engines and Vehicles	1,161	1,205	7,409	4	6	11
Highway Vehicles	ND	ND	73,804	ND	ND	440
Other Area and Point Sources	ND	ND	38,273	ND	ND	38
All Sources	NA	NA	119,486	NA	NA	490

Provo-Orem MSA Inventory B
Emission Inventory Summary - VOC, NOx, CO
Percent of Total Inventory

Equipment Category	% total tpy VOC	% total tpy NOx	% total tpy CO	% total tpsd VOC	% total tpsd NOx	% total tpwd CO
Lawn & Garden	NA	NA	3.52%	NA	NA	0.22%
Airport Service	NA	NA	0.00%	NA	NA	0.00%
Recreational	NA	NA	0.44%	NA	NA	0.91%
Recreational Marine	NA	NA	0.19%	NA	NA	0.00%
Light Commercial	NA	NA	0.79%	NA	NA	0.53%
Industrial	NA	NA	0.32%	NA	NA	0.22%
Construction	NA	NA	0.33%	NA	NA	0.09%
Agricultural	NA	NA	0.34%	NA	NA	0.05%
Logging	NA	NA	0.01%	NA	NA	0.01%
Marine Vessels	NA	NA	0.26%	NA	NA	0.18%
Nonroad Engines and Vehicles	NA	NA	6.20%	NA	NA	2.19%
Highway Vehicles	NA	NA	61.77%	NA	NA	89.97%
Other Area and Point Sources	NA	NA	32.03%	NA	NA	7.84%
All Sources	NA	NA	100.00%	NA	NA	100.00%

Provo-Orem MSA Inventory B
Emission Inventory Summary - Air Toxics and SOx

Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
	tpy					
Lawn & Garden	8	5	12	5	104	5
Airport Service	0	0	0	0	0	0
Recreational	12	1	9	4	16	0
Recreational Marine	3	1	2	1	34	1
Light Commercial	2	1	2	1	12	2
Industrial	4	1	1	0	3	4
Construction	50	11	2	1	2	52
Agricultural	53	14	3	2	5	37
Logging	0	0	0	0	0	0
Marine Vessels	ND	ND	ND	ND	ND	ND
Nonroad Engines and Vehicles	132	35	31	13	177	101
Highway Vehicles	3,668	ND	ND	ND	ND	ND
Other Area and Point Sources	45,615	ND	ND	ND	ND	ND
All Sources	49,415	NA	NA	NA	NA	NA

Provo-Orem MSA Inventory B
Emission Inventory Summary - Air Toxics and SOx
Percent of Total Inventory

Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
	% total tpy					
Lawn & Garden	0.02%	NA	NA	NA	NA	NA
Airport Service	0.00%	NA	NA	NA	NA	NA
Recreational	0.02%	NA	NA	NA	NA	NA
Recreational Marine	0.01%	NA	NA	NA	NA	NA
Light Commercial	0.00%	NA	NA	NA	NA	NA
Industrial	0.01%	NA	NA	NA	NA	NA
Construction	0.10%	NA	NA	NA	NA	NA
Agricultural	0.11%	NA	NA	NA	NA	NA
Logging	0.00%	NA	NA	NA	NA	NA
Marine Vessels	0.00%	NA	NA	NA	NA	NA
Nonroad Engines and Vehicles	0.27%	NA	NA	NA	NA	NA
Highway Vehicles	7.42%	NA	NA	NA	NA	NA
Other Area and Point Sources	92.31%	NA	NA	NA	NA	NA
All Sources	100.00%	NA	NA	NA	NA	NA

Saint Louis MSA Inventory B
Emission Inventory Summary - VOC, NOx, CO

	tpy			tpsd		tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	4,341	158	29,456	23	1	7
Airport Service	199	1,321	1,607	1	4	4
Recreational	750	12	1,271	1	0	11
Recreational Marine	2,406	164	6,354	17	1	0
Light Commercial	1,189	254	14,326	3	1	39
Industrial	699	1,807	10,102	2	5	28
Construction	927	6,548	4,872	4	31	5
Agricultural	753	3,648	3,111	4	20	2
Logging	42	1	126	0	0	0
Marine Vessels	2,488	1,820	ND	7	5	ND
Nonroad Engines and Vehicles	13,793	15,733	71,224	62	67	97
Highway Vehicles	ND	62,039	ND	208	187	1,710
Other Area and Point Sources	ND	158,510	ND	360	434	441
All Sources	NA	236,282	NA	630	688	2,247

Saint Louis MSA Inventory B
Emission Inventory Summary - VOC, NOx, CO
Percent of Total Inventory

	% total tpy			% total tpsd		% total tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	NA	0.07%	NA	3.61%	0.12%	0.30%
Airport Service	NA	0.56%	NA	0.09%	0.53%	0.20%
Recreational	NA	0.01%	NA	0.09%	0.00%	0.48%
Recreational Marine	NA	0.07%	NA	2.78%	0.18%	0.00%
Light Commercial	NA	0.11%	NA	0.52%	0.10%	1.75%
Industrial	NA	0.76%	NA	0.32%	0.72%	1.23%
Construction	NA	2.77%	NA	0.69%	4.48%	0.24%
Agricultural	NA	1.54%	NA	0.65%	2.90%	0.09%
Logging	NA	0.00%	NA	0.02%	0.00%	0.02%
Marine Vessels	NA	0.77%	NA	1.08%	0.72%	0.00%
Nonroad Engines and Vehicles	NA	6.66%	NA	9.86%	9.76%	4.30%
Highway Vehicles	NA	26.26%	NA	32.98%	27.16%	76.07%
Other Area and Point Sources	NA	67.09%	NA	57.16%	63.08%	19.63%
All Sources	NA	100.00%	NA	100.00%	100.00%	100.00%

Saint Louis MSA Inventory B
Emission Inventory Summary - Air Toxics and SOx

Equipment Category	PM	Aldehydes	Benzene	tpy 1,3 But.	Gas. Vap.	SOx
Lawn & Garden	71	40	113	46	833	30
Airport Service	96	7	6	3	4	87
Recreational	28	3	21	9	39	1
Recreational Marine	129	15	63	27	339	17
Light Commercial	35	15	33	13	173	30
Industrial	77	31	19	8	90	75
Construction	545	129	27	14	34	572
Agricultural	409	110	22	12	15	285
Logging	1	0	1	0	4	0
Marine Vessels	184	ND	ND	ND	ND	ND
Nonroad Engines and Vehicles	1,575	349	305	132	1,532	1,097
Highway Vehicles	38,099	ND	ND	ND	ND	ND
Other Area and Point Sources	89,636	ND	ND	ND	ND	ND
All Sources	129,310	NA	NA	NA	NA	NA

Saint Louis MSA Inventory B
Emission Inventory Summary - Air Toxics and SOx
Percent of Total Inventory

Equipment Category	PM	Aldehydes	Benzene	% total tpy 1,3 But.	Gas. Vap.	SOx
Lawn & Garden	0.06%	NA	NA	NA	NA	NA
Airport Service	0.07%	NA	NA	NA	NA	NA
Recreational	0.02%	NA	NA	NA	NA	NA
Recreational Marine	0.10%	NA	NA	NA	NA	NA
Light Commercial	0.03%	NA	NA	NA	NA	NA
Industrial	0.06%	NA	NA	NA	NA	NA
Construction	0.42%	NA	NA	NA	NA	NA
Agricultural	0.32%	NA	NA	NA	NA	NA
Logging	0.00%	NA	NA	NA	NA	NA
Marine Vessels	0.14%	NA	NA	NA	NA	NA
Nonroad Engines and Vehicles	1.22%	NA	NA	NA	NA	NA
Highway Vehicles	29.46%	NA	NA	NA	NA	NA
Other Area and Point Sources	69.32%	NA	NA	NA	NA	NA
All Sources	100.00%	NA	NA	NA	NA	NA

San Diego AB Inventory B
Emission Inventory Summary - VOC, NOx, CO

	tpy			tpsd		tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	2,924	255	33,444	11	1	25
Airport Service	216	1,439	1,750	1	4	5
Recreational	730	17	2,235	3	0	3
Recreational Marine	1,899	270	6,419	9	1	5
Light Commercial	936	241	12,318	3	1	34
Industrial	469	1,181	6,681	1	3	18
Construction	1,056	6,556	6,111	4	24	13
Agricultural	277	1,247	1,409	1	5	1
Logging	33	0	101	0	0	0
Marine Vessels	ND	ND	ND	3	41	7
Nonroad Engines and Vehicles	8,540	11,207	70,468	35	80	111
Highway Vehicles	ND	47,136	570,100	130	142	1,343
Other Area and Point Sources	ND	ND	94,000	271	34	154
All Sources	NA	NA	734,568	436	256	1,608

San Diego AB Inventory B
Emission Inventory Summary - VOC, NOx, CO
Percent of Total Inventory

	% total tpy			% total tpsd		% total tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	NA	NA	4.55%	2.41%	0.37%	1.53%
Airport Service	NA	NA	0.24%	0.14%	1.54%	0.30%
Recreational	NA	NA	0.30%	0.68%	0.03%	0.20%
Recreational Marine	NA	NA	0.87%	2.17%	0.56%	0.31%
Light Commercial	NA	NA	1.68%	0.60%	0.26%	2.10%
Industrial	NA	NA	0.91%	0.31%	1.26%	1.14%
Construction	NA	NA	0.83%	0.88%	9.27%	0.83%
Agricultural	NA	NA	0.19%	0.24%	1.82%	0.06%
Logging	NA	NA	0.01%	0.02%	0.00%	0.02%
Marine Vessels	NA	NA	0.00%	0.57%	16.08%	0.42%
Nonroad Engines and Vehicles	NA	NA	9.59%	8.02%	31.16%	6.89%
Highway Vehicles	NA	NA	77.61%	29.77%	55.51%	83.55%
Other Area and Point Sources	NA	NA	12.80%	62.21%	13.33%	9.56%
All Sources	NA	NA	100.00%	100.00%	100.00%	100.00%

San Diego AB Inventory B
Emission Inventory Summary - Air Toxics and SOx

				tpy		
Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
Lawn & Garden	41	32	75	30	586	42
Airport Service	104	7	6	3	4	95
Recreational	8	4	19	8	95	2
Recreational Marine	73	16	38	16	637	21
Light Commercial	28	12	26	10	151	29
Industrial	48	20	13	6	60	47
Construction	566	129	31	16	50	570
Agricultural	138	38	8	4	14	97
Logging	1	0	1	0	4	0
Marine Vessels	854	ND	ND	ND	ND	6,979
Nonroad Engines and Vehicles	1,861	259	218	94	1,602	7,881
Highway Vehicles	6,935	ND	ND	ND	ND	2,409
Other Area and Point Sources	179,215	ND	ND	ND	ND	3,723
All Sources	188,011	NA	NA	NA	NA	14,013

San Diego AB Inventory B
Emission Inventory Summary - Air Toxics and SOx
Percent of Total Inventory

				% total tpy		
Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
Lawn & Garden	0.02%	NA	NA	NA	NA	0.30%
Airport Service	0.06%	NA	NA	NA	NA	0.68%
Recreational	0.00%	NA	NA	NA	NA	0.01%
Recreational Marine	0.04%	NA	NA	NA	NA	0.15%
Light Commercial	0.02%	NA	NA	NA	NA	0.20%
Industrial	0.03%	NA	NA	NA	NA	0.33%
Construction	0.30%	NA	NA	NA	NA	4.07%
Agricultural	0.07%	NA	NA	NA	NA	0.69%
Logging	0.00%	NA	NA	NA	NA	0.00%
Marine Vessels	0.45%	NA	NA	NA	NA	49.80%
Nonroad Engines and Vehicles	0.99%	NA	NA	NA	NA	56.24%
Highway Vehicles	3.69%	NA	NA	NA	NA	17.19%
Other Area and Point Sources	95.32%	NA	NA	NA	NA	26.57%
All Sources	100.00%	NA	NA	NA	NA	100.00%

San Joaquin AB Inventory B
Emission Inventory Summary - VOC, NOx, CO

	tpy			tpsd		tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	3,402	162	24,984	12	1	22
Airport Service	25	163	202	0	0	1
Recreational	149	3	455	1	0	1
Recreational Marine	372	78	1,257	2	0	1
Light Commercial	985	254	12,969	3	1	36
Industrial	297	1,008	3,664	1	3	10
Construction	988	6,605	5,452	4	24	12
Agricultural	3,608	17,948	14,620	13	67	10
Logging	73	73	248	0	0	1
Marine Vessels	ND	ND	ND	0	3	0
Nonroad Engines and Vehicles	9,899	26,294	63,853	35	99	92
Highway Vehicles	ND	ND	ND	150	240	1,100
Other Area and Point Sources	ND	ND	ND	1,022	249	683
All Sources	NA	NA	NA	1,207	587	1,875

San Joaquin AB Inventory B
Emission Inventory Summary - VOC, NOx, CO
Percent of Total Inventory

	% total tpy			% total tpsd		% total tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	NA	NA	NA	0.97%	0.10%	1.15%
Airport Service	NA	NA	NA	0.01%	0.08%	0.03%
Recreational	NA	NA	NA	0.06%	0.00%	0.03%
Recreational Marine	NA	NA	NA	0.15%	0.07%	0.05%
Light Commercial	NA	NA	NA	0.23%	0.12%	1.90%
Industrial	NA	NA	NA	0.07%	0.47%	0.54%
Construction	NA	NA	NA	0.30%	4.07%	0.64%
Agricultural	NA	NA	NA	1.12%	11.39%	0.51%
Logging	NA	NA	NA	0.02%	0.03%	0.04%
Marine Vessels	NA	NA	NA	0.02%	0.45%	0.02%
Nonroad Engines and Vehicles	NA	NA	NA	2.92%	16.78%	4.90%
Highway Vehicles	NA	NA	NA	12.42%	40.87%	58.66%
Other Area and Point Sources	NA	NA	NA	84.65%	42.35%	36.44%
All Sources	NA	NA	NA	100.00%	100.00%	100.00%

San Joaquin AB Inventory B
Emission Inventory Summary - Air Toxics and SOx

Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
	tpy					
Lawn & Garden	49	30	91	37	580	29
Airport Service	12	1	1	0	0	11
Recreational	2	1	4	2	19	0
Recreational Marine	9	3	5	2	207	5
Light Commercial	30	13	27	11	159	30
Industrial	54	16	8	4	32	50
Construction	555	128	29	15	40	576
Agricultural	1,976	536	106	56	90	1,404
Logging	8	2	2	1	8	6
Marine Vessels	62	ND	ND	ND	ND	402
Nonroad Engines and Vehicles	2,756	730	273	127	1,135	2,513
Highway Vehicles	13,505	ND	ND	ND	ND	9,125
Other Area and Point Sources	731,789	ND	ND	ND	ND	16,790
All Sources	748,050	NA	NA	NA	NA	28,428

San Joaquin AB Inventory B
Emission Inventory Summary - Air Toxics and SOx
Percent of Total Inventory

Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
	% total tpy					
Lawn & Garden	0.01%	NA	NA	NA	NA	0.10%
Airport Service	0.00%	NA	NA	NA	NA	0.04%
Recreational	0.00%	NA	NA	NA	NA	0.00%
Recreational Marine	0.00%	NA	NA	NA	NA	0.02%
Light Commercial	0.00%	NA	NA	NA	NA	0.11%
Industrial	0.01%	NA	NA	NA	NA	0.17%
Construction	0.07%	NA	NA	NA	NA	2.03%
Agricultural	0.26%	NA	NA	NA	NA	4.94%
Logging	0.00%	NA	NA	NA	NA	0.02%
Marine Vessels	0.01%	NA	NA	NA	NA	1.41%
Nonroad Engines and Vehicles	0.37%	NA	NA	NA	NA	8.84%
Highway Vehicles	1.81%	NA	NA	NA	NA	32.10%
Other Area and Point Sources	97.83%	NA	NA	NA	NA	59.06%
All Sources	100.00%	NA	NA	NA	NA	100.00%

Seattle-Tacoma MSA Inventory B
Emission Inventory Summary - VOC, NOx, CO

Equipment Category	tpy VOC	tpy NOx	tpy CO	tpsd VOC	tpsd NOx	tpwd CO
Lawn & Garden	5,055	216	38,545	21	1	18
Airport Service	195	1,295	1,577	1	4	4
Recreational	562	11	1,425	2	0	5
Recreational Marine	4,287	406	9,849	25	3	5
Light Commercial	1,086	272	14,140	3	1	39
Industrial	665	1,617	9,675	2	4	27
Construction	946	6,135	5,463	4	26	9
Agricultural	265	1,276	1,059	1	6	1
Logging	104	587	572	0	2	2
Marine Vessels	2,194	17,253	31,940	6	47	88
Nonroad Engines and Vehicles	15,357	29,068	114,244	64	92	196
Highway Vehicles	ND	ND	267,670	ND	ND	1,515
Other Area and Point Sources	ND	ND	199,979	ND	ND	565
All Sources	NA	NA	581,893	NA	NA	2,276

Seattle-Tacoma MSA Inventory B
Emission Inventory Summary - VOC, NOx, CO
Percent of Total Inventory

Equipment Category	% total tpy VOC	% total tpy NOx	% total tpy CO	% total tpsd VOC	% total tpsd NOx	% total tpwd CO
Lawn & Garden	NA	NA	6.62%	NA	NA	0.78%
Airport Service	NA	NA	0.27%	NA	NA	0.19%
Recreational	NA	NA	0.24%	NA	NA	0.20%
Recreational Marine	NA	NA	1.69%	NA	NA	0.24%
Light Commercial	NA	NA	2.43%	NA	NA	1.70%
Industrial	NA	NA	1.66%	NA	NA	1.16%
Construction	NA	NA	0.94%	NA	NA	0.39%
Agricultural	NA	NA	0.18%	NA	NA	0.03%
Logging	NA	NA	0.10%	NA	NA	0.07%
Marine Vessels	NA	NA	5.49%	NA	NA	3.85%
Nonroad Engines and Vehicles	NA	NA	19.63%	NA	NA	8.61%
Highway Vehicles	NA	NA	46.00%	NA	NA	66.56%
Other Area and Point Sources	NA	NA	34.37%	NA	NA	24.82%
All Sources	NA	NA	100.00%	NA	NA	100.00%

Seattle-Tacoma MSA Inventory B
Emission Inventory Summary - Air Toxics and SOx

Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
	tpy					
Lawn & Garden	84	49	134	54	893	40
Airport Service	94	7	6	3	4	86
Recreational	12	3	15	7	60	1
Recreational Marine	215	24	100	43	994	37
Light Commercial	33	14	30	12	178	32
Industrial	59	27	16	8	92	58
Construction	521	116	28	14	44	528
Agricultural	142	38	8	4	12	100
Logging	51	11	3	1	9	49
Marine Vessels	1,017	ND	ND	ND	ND	7,576
Nonroad Engines and Vehicles	2,226	289	341	145	2,285	8,506
Highway Vehicles	30,151	ND	ND	ND	ND	ND
Other Area and Point Sources	37,878	ND	ND	ND	ND	ND
All Sources	70,255	NA	NA	NA	NA	NA

Seattle-Tacoma MSA Inventory B
Emission Inventory Summary - Air Toxics and SOx
Percent of Total Inventory

Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
	% total tpy					
Lawn & Garden	0.12%	NA	NA	NA	NA	NA
Airport Service	0.13%	NA	NA	NA	NA	NA
Recreational	0.02%	NA	NA	NA	NA	NA
Recreational Marine	0.31%	NA	NA	NA	NA	NA
Light Commercial	0.05%	NA	NA	NA	NA	NA
Industrial	0.08%	NA	NA	NA	NA	NA
Construction	0.74%	NA	NA	NA	NA	NA
Agricultural	0.20%	NA	NA	NA	NA	NA
Logging	0.07%	NA	NA	NA	NA	NA
Marine Vessels	1.45%	NA	NA	NA	NA	NA
Nonroad Engines and Vehicles	3.17%	NA	NA	NA	NA	NA
Highway Vehicles	42.92%	NA	NA	NA	NA	NA
Other Area and Point Sources	53.91%	NA	NA	NA	NA	NA
All Sources	100.00%	NA	NA	NA	NA	NA

South Coast AB Inventory B
Emission Inventory Summary - VOC, NOx, CO

	tpy			tpsd		tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	10,386	745	107,890	37	3	81
Airport Service	818	5,447	6,618	2	15	18
Recreational	2,642	61	8,101	11	0	12
Recreational Marine	5,734	835	19,498	28	4	15
Light Commercial	7,532	1,944	99,164	21	5	272
Industrial	3,690	12,389	46,016	10	34	126
Construction	4,789	28,719	27,579	17	104	60
Agricultural	749	2,979	4,702	3	11	3
Logging	141	29	436	0	0	1
Marine Vessels	ND	ND	ND	7	68	10
Nonroad Engines and Vehicles	36,481	53,148	320,004	138	245	599
Highway Vehicles	ND	ND	ND	650	660	9,732
Other Area and Point Sources	ND	ND	ND	1,400	334	265
All Sources	NA	NA	NA	2,188	1,239	10,596

South Coast AB Inventory B
Emission Inventory Summary - VOC, NOx, CO
Percent of Total Inventory

	% total tpy			% total tpsd		% total tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	NA	NA	NA	1.68%	0.22%	0.77%
Airport Service	NA	NA	NA	0.10%	1.20%	0.17%
Recreational	NA	NA	NA	0.49%	0.02%	0.11%
Recreational Marine	NA	NA	NA	1.30%	0.35%	0.14%
Light Commercial	NA	NA	NA	0.96%	0.43%	2.56%
Industrial	NA	NA	NA	0.48%	2.74%	1.19%
Construction	NA	NA	NA	0.79%	8.38%	0.57%
Agricultural	NA	NA	NA	0.13%	0.90%	0.03%
Logging	NA	NA	NA	0.02%	0.01%	0.01%
Marine Vessels	NA	NA	NA	0.33%	5.52%	0.10%
Nonroad Engines and Vehicles	NA	NA	NA	6.29%	19.78%	5.65%
Highway Vehicles	NA	NA	NA	29.71%	53.28%	91.85%
Other Area and Point Sources	NA	NA	NA	64.00%	26.94%	2.50%
All Sources	NA	NA	NA	100.00%	100.00%	100.00%

South Coast AB Inventory B
Emission Inventory Summary - Air Toxics and SOx

Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
	tpy					
Lawn & Garden	145	112	282	115	1,551	128
Airport Service	394	28	24	12	16	360
Recreational	27	14	71	30	344	6
Recreational Marine	215	49	114	49	1,980	64
Light Commercial	229	96	207	83	1,218	230
Industrial	659	202	102	46	391	612
Construction	2,441	564	140	70	239	2,495
Agricultural	324	90	20	10	81	231
Logging	5	2	4	2	15	3
Marine Vessels	1,515	ND	ND	ND	ND	12,797
Nonroad Engines and Vehicles	5,955	1,158	964	417	5,835	16,925
Highway Vehicles	34,675	ND	ND	ND	ND	11,680
Other Area and Point Sources	766,500	ND	ND	ND	ND	18,214
All Sources	807,130	NA	NA	NA	NA	46,818

South Coast AB Inventory B
Emission Inventory Summary - Air Toxics and SOx
Percent of Total Inventory

Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
	% total tpy					
Lawn & Garden	0.02%	NA	NA	NA	NA	0.27%
Airport Service	0.05%	NA	NA	NA	NA	0.77%
Recreational	0.00%	NA	NA	NA	NA	0.01%
Recreational Marine	0.03%	NA	NA	NA	NA	0.14%
Light Commercial	0.03%	NA	NA	NA	NA	0.49%
Industrial	0.08%	NA	NA	NA	NA	1.31%
Construction	0.30%	NA	NA	NA	NA	5.33%
Agricultural	0.04%	NA	NA	NA	NA	0.49%
Logging	0.00%	NA	NA	NA	NA	0.01%
Marine Vessels	0.19%	NA	NA	NA	NA	27.33%
Nonroad Engines and Vehicles	0.74%	NA	NA	NA	NA	36.15%
Highway Vehicles	4.30%	NA	NA	NA	NA	24.95%
Other Area and Point Sources	94.97%	NA	NA	NA	NA	38.90%
All Sources	100.00%	NA	NA	NA	NA	100.00%

Springfield MSA Inventory B
Emission Inventory Summary - VOC, NOx, CO

	tpy			tpsd		tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	913	36	6,145	5	0	2
Airport Service	0	0	0	0	0	0
Recreational	393	6	673	0	0	6
Recreational Marine	471	60	1,719	3	0	0
Light Commercial	278	60	3,358	1	0	9
Industrial	161	413	2,341	0	1	6
Construction	186	1,450	966	1	7	1
Agricultural	79	353	385	0	2	0
Logging	12	31	43	0	0	0
Marine Vessels	0	0	0	0	0	ND
Nonroad Engines and Vehicles	2,494	2,409	15,630	11	11	25
Highway Vehicles	ND	ND	ND	62	30	ND
Other Area and Point Sources	ND	ND	ND	50	30	ND
All Sources	NA	NA	NA	123	71	NA

Springfield MSA Inventory B
Emission Inventory Summary - VOC, NOx, CO
Percent of Total Inventory

	% total tpy			% total tpsd		% total tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	NA	NA	NA	3.87%	0.27%	NA
Airport Service	NA	NA	NA	0.00%	0.00%	NA
Recreational	NA	NA	NA	0.26%	0.01%	NA
Recreational Marine	NA	NA	NA	2.56%	0.63%	NA
Light Commercial	NA	NA	NA	0.63%	0.23%	NA
Industrial	NA	NA	NA	0.38%	1.59%	NA
Construction	NA	NA	NA	0.71%	9.61%	NA
Agricultural	NA	NA	NA	0.35%	2.72%	NA
Logging	NA	NA	NA	0.03%	0.12%	NA
Marine Vessels	NA	NA	NA	0.00%	0.00%	NA
Nonroad Engines and Vehicles	NA	NA	NA	8.79%	15.19%	NA
Highway Vehicles	NA	NA	NA	50.82%	42.62%	NA
Other Area and Point Sources	NA	NA	NA	40.40%	42.19%	NA
All Sources	NA	NA	NA	100.00%	100.00%	NA

Springfield MSA Inventory B
Emission Inventory Summary - Air Toxics and SOx

Equipment Category	PM	Aldehydes	Benzene	tpy 1,3 But.	Gas. Vap.	SOx
Lawn & Garden	15	8	23	9	185	7
Airport Service	0	0	0	0	0	0
Recreational	15	1	11	5	21	1
Recreational Marine	19	4	11	4	126	5
Light Commercial	8	3	8	3	40	7
Industrial	17	7	4	2	21	17
Construction	121	27	5	3	5	125
Agricultural	39	11	2	1	4	27
Logging	3	1	0	0	1	3
Marine Vessels	0	0	ND	ND	ND	0
Nonroad Engines and Vehicles	237	63	65	28	402	191
Highway Vehicles	ND	ND	ND	ND	ND	ND
Other Area and Point Sources	ND	ND	ND	ND	ND	ND
All Sources	NA	NA	NA	NA	NA	NA

Springfield MSA Inventory B
Emission Inventory Summary - Air Toxics and SOx
Percent of Total Inventory

Equipment Category	PM	Aldehydes	Benzene	% total tpy 1,3 But.	Gas. Vap.	SOx
Lawn & Garden	NA	NA	NA	NA	NA	NA
Airport Service	NA	NA	NA	NA	NA	NA
Recreational	NA	NA	NA	NA	NA	NA
Recreational Marine	NA	NA	NA	NA	NA	NA
Light Commercial	NA	NA	NA	NA	NA	NA
Industrial	NA	NA	NA	NA	NA	NA
Construction	NA	NA	NA	NA	NA	NA
Agricultural	NA	NA	NA	NA	NA	NA
Logging	NA	NA	NA	NA	NA	NA
Marine Vessels	NA	NA	NA	NA	NA	NA
Nonroad Engines and Vehicles	NA	NA	NA	NA	NA	NA
Highway Vehicles	NA	NA	NA	NA	NA	NA
Other Area and Point Sources	NA	NA	NA	NA	NA	NA
All Sources	NA	NA	NA	NA	NA	NA

Spokane MSA Inventory B
Emission Inventory Summary - VOC, NOx, CO

	tpy			tpsd		tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	955	35	6,400	5	0	0
Airport Service	27	178	221	0	0	1
Recreational	104	2	254	0	0	1
Recreational Marine	270	12	549	2	0	0
Light Commercial	169	39	2,107	0	0	6
Industrial	55	136	799	0	0	2
Construction	100	694	533	0	3	1
Agricultural	137	644	575	1	4	0
Logging	9	16	31	0	0	0
Marine Vessels	ND	ND	245	ND	ND	1
Nonroad Engines and Vehicles	1,824	1,756	11,714	9	8	11
Highway Vehicles	ND	ND	9,026	ND	ND	251
Other Area and Point Sources	ND	ND	77,748	ND	ND	224
All Sources	NA	NA	98,488	NA	NA	486

Spokane MSA Inventory B
Emission Inventory Summary - VOC, NOx, CO
Percent of Total Inventory

	% total tpy			% total tpsd		% total tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	NA	NA	6.50%	NA	NA	0.02%
Airport Service	NA	NA	0.22%	NA	NA	0.12%
Recreational	NA	NA	0.26%	NA	NA	0.16%
Recreational Marine	NA	NA	0.56%	NA	NA	0.00%
Light Commercial	NA	NA	2.14%	NA	NA	1.19%
Industrial	NA	NA	0.81%	NA	NA	0.45%
Construction	NA	NA	0.54%	NA	NA	0.12%
Agricultural	NA	NA	0.58%	NA	NA	0.08%
Logging	NA	NA	0.03%	NA	NA	0.02%
Marine Vessels	NA	NA	0.25%	NA	NA	0.14%
Nonroad Engines and Vehicles	NA	NA	11.89%	NA	NA	2.29%
Highway Vehicles	NA	NA	9.16%	NA	NA	51.67%
Other Area and Point Sources	NA	NA	78.94%	NA	NA	46.04%
All Sources	NA	NA	100.00%	NA	NA	100.00%

Spokane MSA Inventory B
Emission Inventory Summary - Air Toxics and SOx

Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
	tpy					
Lawn & Garden	17	9	25	10	175	7
Airport Service	13	1	1	0	1	12
Recreational	2	0	3	1	12	0
Recreational Marine	16	1	7	3	26	2
Light Commercial	5	2	5	2	26	5
Industrial	5	2	1	1	7	5
Construction	58	13	3	2	4	60
Agricultural	72	19	4	2	4	50
Logging	2	0	0	0	1	1
Marine Vessels	ND	ND	ND	ND	ND	ND
Nonroad Engines and Vehicles	190	49	49	21	256	142
Highway Vehicles	3,881	ND	ND	ND	ND	ND
Other Area and Point Sources	9,837	ND	ND	ND	ND	ND
All Sources	13,908	NA	NA	NA	NA	NA

Spokane MSA Inventory B
Emission Inventory Summary - Air Toxics and SOx
Percent of Total Inventory

Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
	% total tpy					
Lawn & Garden	0.12%	NA	NA	NA	NA	NA
Airport Service	0.09%	NA	NA	NA	NA	NA
Recreational	0.02%	NA	NA	NA	NA	NA
Recreational Marine	0.11%	NA	NA	NA	NA	NA
Light Commercial	0.04%	NA	NA	NA	NA	NA
Industrial	0.04%	NA	NA	NA	NA	NA
Construction	0.42%	NA	NA	NA	NA	NA
Agricultural	0.52%	NA	NA	NA	NA	NA
Logging	0.01%	NA	NA	NA	NA	NA
Marine Vessels	0.00%	NA	NA	NA	NA	NA
Nonroad Engines and Vehicles	1.37%	NA	NA	NA	NA	NA
Highway Vehicles	27.90%	NA	NA	NA	NA	NA
Other Area and Point Sources	70.73%	NA	NA	NA	NA	NA
All Sources	100.00%	NA	NA	NA	NA	NA

Washington DC MSA Inventory B
Emission Inventory Summary - VOC, NOx, CO

Equipment Category	tpy VOC	tpy NOx	tpy CO	tpsd VOC	tpsd NOx	tpwd CO
Lawn & Garden	9,877	729	114,627	41	3	46
Airport Service	389	2,589	3,148	1	7	9
Recreational	722	13	1,594	2	0	8
Recreational Marine	1,555	143	4,603	9	1	1
Light Commercial	1,204	278	15,084	3	1	41
Industrial	435	1,054	6,420	1	3	18
Construction	1,747	12,070	9,238	7	50	15
Agricultural	534	2,422	2,639	2	11	2
Logging	78	25	241	0	0	1
Marine Vessels	806	227	2,820	2	1	8
Nonroad Engines and Vehicles	17,347	19,551	160,415	69	76	148
Highway Vehicles	ND	83,068	398,686	345	250	2,161
Other Area and Point Sources	ND	88,336	59,024	202	242	167
All Sources	NA	190,955	618,125	616	569	2,475

Washington DC MSA Inventory B
Emission Inventory Summary - VOC, NOx, CO
Percent of Total Inventory

Equipment Category	% total tpy VOC	% total tpy NOx	% total tpy CO	% total tpsd VOC	% total tpsd NOx	% total tpwd CO
Lawn & Garden	NA	0.38%	18.54%	6.64%	0.56%	1.87%
Airport Service	NA	1.36%	0.51%	0.17%	1.25%	0.35%
Recreational	NA	0.01%	0.26%	0.25%	0.01%	0.31%
Recreational Marine	NA	0.08%	0.74%	1.49%	0.16%	0.04%
Light Commercial	NA	0.15%	2.44%	0.54%	0.13%	1.67%
Industrial	NA	0.55%	1.04%	0.20%	0.51%	0.71%
Construction	NA	6.32%	1.49%	1.18%	8.84%	0.61%
Agricultural	NA	1.27%	0.43%	0.38%	1.87%	0.07%
Logging	NA	0.01%	0.04%	0.03%	0.01%	0.03%
Marine Vessels	NA	0.12%	0.46%	0.36%	0.11%	0.31%
Nonroad Engines and Vehicles	NA	10.24%	25.95%	11.25%	13.44%	5.98%
Highway Vehicles	NA	43.50%	64.50%	55.97%	44.01%	87.29%
Other Area and Point Sources	NA	46.26%	9.55%	32.77%	42.55%	6.74%
All Sources	NA	100.00%	100.00%	100.00%	100.00%	100.00%

Washington DC MSA Inventory B
Emission Inventory Summary - Air Toxics and SOx

Equipment Category	PM	Aldehydes	Benzene	tpy 1,3 But.	Gas. Vap.	SOx
Lawn & Garden	116	103	222	89	3,045	127
Airport Service	187	13	12	6	8	171
Recreational	20	3	20	9	60	1
Recreational Marine	76	11	38	16	300	13
Light Commercial	36	15	33	13	185	33
Industrial	37	18	12	5	61	36
Construction	1,006	234	51	26	62	1,050
Agricultural	269	73	15	8	24	189
Logging	4	1	2	1	8	2
Marine Vessels	ND	ND	ND	ND	ND	ND
Nonroad Engines and Vehicles	1,751	472	405	173	3,754	1,623
Highway Vehicles	ND	ND	ND	ND	ND	ND
Other Area and Point Sources	ND	ND	ND	ND	ND	ND
All Sources	NA	NA	NA	NA	NA	NA

Washington DC MSA Inventory B
Emission Inventory Summary - Air Toxics and SOx
Percent of Total Inventory

Equipment Category	PM	Aldehydes	Benzene	% total tpy 1,3 But.	Gas. Vap.	SOx
Lawn & Garden	NA	NA	NA	NA	NA	NA
Airport Service	NA	NA	NA	NA	NA	NA
Recreational	NA	NA	NA	NA	NA	NA
Recreational Marine	NA	NA	NA	NA	NA	NA
Light Commercial	NA	NA	NA	NA	NA	NA
Industrial	NA	NA	NA	NA	NA	NA
Construction	NA	NA	NA	NA	NA	NA
Agricultural	NA	NA	NA	NA	NA	NA
Logging	NA	NA	NA	NA	NA	NA
Marine Vessels	NA	NA	NA	NA	NA	NA
Nonroad Engines and Vehicles	NA	NA	NA	NA	NA	NA
Highway Vehicles	NA	NA	NA	NA	NA	NA
Other Area and Point Sources	NA	NA	NA	NA	NA	NA
All Sources	NA	NA	NA	NA	NA	NA

USA Inventory B (in-use est.)
Emission Inventory Summary - VOC, NOx, CO

	tpy			tpsd		tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	747,762	8,564	5,277,532	2,848	37	3,764
Airport Service	17,046	104,233	151,433	47	286	415
Recreational	696,612	4,905	1,153,782	536	3	9,300
Recreational Marine	845,721	46,724	2,407,446	5,149	292	528
Light Commercial	165,960	30,233	3,694,644	461	83	10,122
Industrial	88,909	168,934	1,277,124	252	463	3,499
Construction	127,178	884,373	722,204	530	3,683	1,187
Agricultural	198,900	936,809	909,196	872	4,107	598
Logging	17,761	62,752	80,333	49	172	220
Marine Vessels	543,464	218,799	1,822,527	1,489	599	4,993
Nonroad Engines and Vehicles	3,449,313	2,466,327	17,496,221	12,232	9,724	34,626
Highway Vehicles	5,639,454	6,547,763	36,034,743	16,996	19,733	84.904
Other Area and Point Sources	13,684,163	13,955,333	24,460,414	37,491	38,234	87,207
All Sources	22,772,930	22,969,423	77,991,378	66,719	67,690	206.736

USA Inventory B (in-use est.)
Emission Inventory Summary - VOC, NOx, CO
Percent of Total Inventory

	% total tpy			% total tpsd		% total tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	3.28%	0.04%	6.77%	4.27%	0.05%	1.82%
Airport Service	0.07%	0.45%	0.19%	0.07%	0.42%	0.20%
Recreational	3.06%	0.02%	1.48%	0.80%	0.00%	4.50%
Recreational Marine	3.71%	0.20%	3.09%	7.72%	0.43%	0.26%
Light Commercial	0.73%	0.13%	4.74%	0.69%	0.12%	4.90%
Industrial	0.39%	0.74%	1.64%	0.38%	0.68%	1.69%
Construction	0.56%	3.85%	0.93%	0.79%	5.44%	0.57%
Agricultural	0.87%	4.08%	1.17%	1.31%	6.07%	0.29%
Logging	0.08%	0.27%	0.10%	0.07%	0.25%	0.11%
Marine Vessels	2.39%	0.95%	2.34%	2.23%	0.89%	2.42%
Nonroad Engines and Vehicles	15.15%	10.74%	22.43%	18.33%	14.36%	16.75%
Highway Vehicles	24.76%	28.51%	46.20%	25.47%	29.15%	41.07%
Other Area and Point Sources	60.09%	60.76%	31.36%	56.19%	56.48%	42.18%
All Sources	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

USA Inventory B (in-use est.)
Emission Inventory Summary - Air Toxics and SOx

Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
	tpy					
Lawn & Garden	10,490	3,596	20,981	8,790	71,703	2,976
Airport Service	7,542	529	506	252	315	6,892
Recreational	13,096	1,325	20,436	8,825	17,772	509
Recreational Marine	38,557	4,635	23,063	9,920	83,076	4,844
Light Commercial	3,407	1,468	4,602	1,851	24,424	4,366
Industrial	6,807	2,901	2,464	1,070	8,873	6,647
Construction	72,787	17,284	3,751	1,911	3,631	77,443
Agricultural	105,246	28,259	5,882	3,096	3,310	73,117
Logging	5,766	1,190	520	234	877	5,193
Marine Vessels	16,204	ND	ND	ND	ND	24,604
Nonroad Engines and Vehicles	279,901	61,188	82,205	35,949	213,981	206,592
Highway Vehicles	1,397,738	ND	ND	ND	ND	652,572
Other Area and Point Sources	6,384,620	ND	ND	ND	ND	22,311,998
All Sources	8,062,259	NA	NA	NA	NA	23,171,162

USA Inventory B (in-use est.)
Emission Inventory Summary - Air Toxics and SOx
Percent of Total Inventory

Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
	% total tpy					
Lawn & Garden	0.13%	NA	NA	NA	NA	0.01%
Airport Service	0.09%	NA	NA	NA	NA	0.03%
Recreational	0.16%	NA	NA	NA	NA	0.00%
Recreational Marine	0.48%	NA	NA	NA	NA	0.02%
Light Commercial	0.04%	NA	NA	NA	NA	0.02%
Industrial	0.08%	NA	NA	NA	NA	0.03%
Construction	0.90%	NA	NA	NA	NA	0.33%
Agricultural	1.31%	NA	NA	NA	NA	0.32%
Logging	0.07%	NA	NA	NA	NA	0.02%
Marine Vessels	0.20%	NA	NA	NA	NA	0.11%
Nonroad Engines and Vehicles	3.47%	NA	NA	NA	NA	0.89%
Highway Vehicles	17.34%	NA	NA	NA	NA	2.82%
Other Area and Point Sources	79.19%	NA	NA	NA	NA	96.29%
All Sources	100.00%	NA	NA	NA	NA	100.00%

Atlanta MSA Inventory B (in-use est.)
Emission Inventory Summary - VOC, NOx, CO

Equipment Category	tpy VOC	tpy NOx	tpy CO	tpsd VOC	tpsd NOx	tpwd CO
Lawn & Garden	10,870	137	90,840	38	1	72
Airport Service	339	2,073	3,009	1	6	8
Recreational	433	2	1,358	2	0	3
Recreational Marine	1,758	84	4,488	9	0	3
Light Commercial	2,258	263	31,480	6	1	86
Industrial	1,238	2,166	18,127	4	6	50
Construction	1,959	13,594	10,833	7	49	24
Agricultural	345	1,584	1,470	1	6	1
Logging	172	111	524	0	0	1
Marine Vessels	0	0	ND	0	0	ND
Nonroad Engines and Vehicles	19,371	20,015	162,130	68	69	248
Highway Vehicles	ND	69,146	ND	319	208	ND
Other Area and Point Sources	ND	92,553	ND	287	248	ND
All Sources	NA	181,714	NA	674	525	NA

Atlanta MSA Inventory B (in-use est.)
Emission Inventory Summary - VOC, NOx, CO
Percent of Total Inventory

Equipment Category	% total tpy VOC	% total tpy NOx	% total tpy CO	% total tpsd VOC	% total tpsd NOx	% total tpwd CO
Lawn & Garden	NA	0.08%	NA	5.64%	0.10%	NA
Airport Service	NA	1.14%	NA	0.14%	1.08%	NA
Recreational	NA	0.00%	NA	0.25%	0.00%	NA
Recreational Marine	NA	0.05%	NA	1.35%	0.08%	NA
Light Commercial	NA	0.14%	NA	0.93%	0.14%	NA
Industrial	NA	1.19%	NA	0.52%	1.13%	NA
Construction	NA	7.48%	NA	1.05%	9.36%	NA
Agricultural	NA	0.87%	NA	0.19%	1.12%	NA
Logging	NA	0.06%	NA	0.07%	0.06%	NA
Marine Vessels	NA	0.00%	NA	0.00%	0.00%	NA
Nonroad Engines and Vehicles	NA	11.01%	NA	10.14%	13.07%	NA
Highway Vehicles	NA	38.05%	NA	47.29%	39.67%	NA
Other Area and Point Sources	NA	50.93%	NA	42.57%	47.26%	NA
All Sources	NA	100.00%	NA	100.00%	100.00%	NA

Atlanta MSA Inventory B (in-use est.)
Emission Inventory Summary - Air Toxics and SOx

Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
				tpy		
Lawn & Garden	164	56	303	127	1,127	51
Airport Service	150	11	10	5	6	137
Recreational	4	1	12	5	29	1
Recreational Marine	83	9	48	21	171	9
Light Commercial	45	16	65	27	209	38
Industrial	62	36	34	15	142	62
Construction	1,116	267	58	30	51	1,192
Agricultural	178	48	10	5	17	124
Logging	16	3	5	2	9	9
Marine Vessels	ND	ND	ND	ND	ND	ND
Nonroad Engines and Vehicles	1,816	446	545	236	1,761	1,623
Highway Vehicles	ND	ND	ND	ND	ND	ND
Other Area and Point Sources	ND	ND	ND	ND	ND	ND
All Sources	NA	NA	NA	NA	NA	NA

Atlanta MSA Inventory B (in-use est.)
Emission Inventory Summary - Air Toxics and SOx
Percent of Total Inventory

Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
				% total tpy		
Lawn & Garden	NA	NA	NA	NA	NA	NA
Airport Service	NA	NA	NA	NA	NA	NA
Recreational	NA	NA	NA	NA	NA	NA
Recreational Marine	NA	NA	NA	NA	NA	NA
Light Commercial	NA	NA	NA	NA	NA	NA
Industrial	NA	NA	NA	NA	NA	NA
Construction	NA	NA	NA	NA	NA	NA
Agricultural	NA	NA	NA	NA	NA	NA
Logging	NA	NA	NA	NA	NA	NA
Marine Vessels	NA	NA	NA	NA	NA	NA
Nonroad Engines and Vehicles	NA	NA	NA	NA	NA	NA
Highway Vehicles	NA	NA	NA	NA	NA	NA
Other Area and Point Sources	NA	NA	NA	NA	NA	NA
All Sources	NA	NA	NA	NA	NA	NA

Baltimore MSA Inventory B (in-use est.)
Emission Inventory Summary - VOC, NOx, CO

Equipment Category	tpy VOC	tpy NOx	tpy CO	tpsd VOC	tpsd NOx	tpwd CO
Lawn & Garden	6,140	80	47,901	23	0	32
Airport Service	321	1,962	2,855	1	5	8
Recreational	1,251	9	2,072	1	0	17
Recreational Marine	2,685	351	10,558	16	2	2
Light Commercial	1,819	192	24,055	5	1	66
Industrial	720	1,321	10,431	2	4	29
Construction	1,242	8,771	6,950	5	37	11
Agricultural	435	2,065	1,840	2	9	1
Logging	101	8	294	0	0	1
Marine Vessels	1,623	5,970	30,332	4	16	83
Nonroad Engines and Vehicles	16,338	20,729	137,288	60	74	250
Highway Vehicles	ND	54,317	ND	200	164	1,328
Other Area and Point Sources	ND	59,976	34,462	226	164	226
All Sources	NA	135,022	NA	486	402	1,803

Baltimore MSA Inventory B (in-use est.)
Emission Inventory Summary - VOC, NOx, CO
Percent of Total Inventory

Equipment Category	% total tpy VOC	% total tpy NOx	% total tpy CO	% total tpsd VOC	% total tpsd NOx	% total tpwd CO
Lawn & Garden	NA	0.06%	NA	4.82%	0.09%	1.76%
Airport Service	NA	1.45%	NA	0.18%	1.34%	0.43%
Recreational	NA	0.01%	NA	0.20%	0.00%	0.93%
Recreational Marine	NA	0.26%	NA	3.34%	0.55%	0.13%
Light Commercial	NA	0.14%	NA	1.03%	0.13%	3.66%
Industrial	NA	0.98%	NA	0.42%	0.90%	1.59%
Construction	NA	6.50%	NA	1.06%	9.09%	0.63%
Agricultural	NA	1.53%	NA	0.39%	2.25%	0.07%
Logging	NA	0.01%	NA	0.06%	0.01%	0.04%
Marine Vessels	NA	4.42%	NA	0.91%	4.07%	4.61%
Nonroad Engines and Vehicles	NA	15.35%	NA	12.42%	18.41%	13.84%
Highway Vehicles	NA	40.23%	NA	41.12%	40.72%	73.63%
Other Area and Point Sources	NA	44.42%	NA	46.46%	40.87%	12.53%
All Sources	NA	100.00%	NA	100.00%	100.00%	100.00%

Baltimore MSA Inventory B (in-use est.)
Emission Inventory Summary - Air Toxics and SOx

Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
	tpy					
Lawn & Garden	83	30	171	72	616	28
Airport Service	142	10	10	5	6	130
Recreational	24	2	37	16	32	1
Recreational Marine	112	21	71	31	337	28
Light Commercial	35	13	52	22	156	28
Industrial	45	22	20	9	79	44
Construction	722	171	37	19	33	764
Agricultural	231	62	13	7	15	161
Logging	5	1	3	1	5	1
Marine Vessels	302	ND	ND	ND	ND	1,719
Nonroad Engines and Vehicles	1,700	332	413	180	1,278	2,902
Highway Vehicles	ND	ND	ND	ND	ND	ND
Other Area and Point Sources	ND	ND	ND	ND	ND	ND
All Sources	NA	NA	NA	NA	NA	NA

Baltimore MSA Inventory B (in-use est.)
Emission Inventory Summary - Air Toxics and SOx
Percent of Total Inventory

Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
	% total tpy					
Lawn & Garden	NA	NA	NA	NA	NA	NA
Airport Service	NA	NA	NA	NA	NA	NA
Recreational	NA	NA	NA	NA	NA	NA
Recreational Marine	NA	NA	NA	NA	NA	NA
Light Commercial	NA	NA	NA	NA	NA	NA
Industrial	NA	NA	NA	NA	NA	NA
Construction	NA	NA	NA	NA	NA	NA
Agricultural	NA	NA	NA	NA	NA	NA
Logging	NA	NA	NA	NA	NA	NA
Marine Vessels	NA	NA	NA	NA	NA	NA
Nonroad Engines and Vehicles	NA	NA	NA	NA	NA	NA
Highway Vehicles	NA	NA	NA	NA	NA	NA
Other Area and Point Sources	NA	NA	NA	NA	NA	NA
All Sources	NA	NA	NA	NA	NA	NA

Baton Rouge CMSA Inventory B (in-use est.)
Emission Inventory Summary - VOC, NOx, CO

Equipment Category	tpy VOC	tpy NOx	tpy CO	tpsd VOC	tpsd NOx	tpwd CO
Lawn & Garden	1,967	33	20,801	7	0	15
Airport Service	247	1,510	2,190	1	4	6
Recreational	371	2	1,164	2	0	2
Recreational Marine	1,387	41	2,826	7	0	2
Light Commercial	908	106	12,658	3	0	35
Industrial	178	331	2,531	1	1	7
Construction	522	2,588	3,447	2	9	8
Agricultural	112	520	533	0	2	0
Logging	21	95	105	0	0	0
Marine Vessels	108	1,849	394	0	5	1
Nonroad Engines and Vehicles	5,820	7,075	46,649	22	22	75
Highway Vehicles	ND	14,555	ND	64	44	ND
Other Area and Point Sources	ND	82,744	ND	270	227	ND
All Sources	NA	104,374	NA	356	293	NA

Baton Rouge CMSA Inventory B (in-use est.)
Emission Inventory Summary - VOC, NOx, CO
Percent of Total Inventory

Equipment Category	% total tpy VOC	% total tpy NOx	% total tpy CO	% total tpsd VOC	% total tpsd NOx	% total tpwd CO
Lawn & Garden	NA	0.03%	NA	2.02%	0.04%	NA
Airport Service	NA	1.45%	NA	0.19%	1.41%	NA
Recreational	NA	0.00%	NA	0.42%	0.00%	NA
Recreational Marine	NA	0.04%	NA	2.03%	0.07%	NA
Light Commercial	NA	0.10%	NA	0.70%	0.10%	NA
Industrial	NA	0.32%	NA	0.14%	0.31%	NA
Construction	NA	2.48%	NA	0.53%	3.20%	NA
Agricultural	NA	0.50%	NA	0.12%	0.66%	NA
Logging	NA	0.09%	NA	0.02%	0.09%	NA
Marine Vessels	NA	1.77%	NA	0.08%	1.73%	NA
Nonroad Engines and Vehicles	NA	6.78%	NA	6.25%	7.62%	NA
Highway Vehicles	NA	13.95%	NA	17.96%	14.98%	NA
Other Area and Point Sources	NA	79.28%	NA	75.78%	77.41%	NA
All Sources	NA	100.00%	NA	100.00%	100.00%	NA

Baton Rouge CMSA Inventory B (in-use est.)
Emission Inventory Summary - Air Toxics and SOx

Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
	tpy					
Lawn & Garden	33	11	53	22	254	12
Airport Service	109	8	7	4	4	100
Recreational	3	1	10	4	25	0
Recreational Marine	70	5	39	17	94	6
Light Commercial	18	7	26	11	84	15
Industrial	12	6	5	2	19	12
Construction	224	51	15	7	24	226
Agricultural	58	16	3	2	3	41
Logging	9	2	1	0	1	8
Marine Vessels	109	ND	ND	ND	ND	739
Nonroad Engines and Vehicles	646	106	160	70	508	1,159
Highway Vehicles	ND	ND	ND	ND	ND	ND
Other Area and Point Sources	ND	ND	ND	ND	ND	ND
All Sources	NA	NA	NA	NA	NA	NA

Baton Rouge CMSA Inventory B (in-use est.)
Emission Inventory Summary - Air Toxics and SOx
Percent of Total Inventory

Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
	% total tpy					
Lawn & Garden	NA	NA	NA	NA	NA	NA
Airport Service	NA	NA	NA	NA	NA	NA
Recreational	NA	NA	NA	NA	NA	NA
Recreational Marine	NA	NA	NA	NA	NA	NA
Light Commercial	NA	NA	NA	NA	NA	NA
Industrial	NA	NA	NA	NA	NA	NA
Construction	NA	NA	NA	NA	NA	NA
Agricultural	NA	NA	NA	NA	NA	NA
Logging	NA	NA	NA	NA	NA	NA
Marine Vessels	NA	NA	NA	NA	NA	NA
Nonroad Engines and Vehicles	NA	NA	NA	NA	NA	NA
Highway Vehicles	NA	NA	NA	NA	NA	NA
Other Area and Point Sources	NA	NA	NA	NA	NA	NA
All Sources	NA	NA	NA	NA	NA	NA

Boston CMSA Inventory B (in-use est.)
Emission Inventory Summary - VOC, NOx, CO

Equipment Category	tpy VOC	tpy NOx	tpy CO	tpsd VOC	tpsd NOx	tpwd CO
Lawn & Garden	7,989	100	59,813	41	1	20
Airport Service	409	2,496	3,630	1	7	10
Recreational	4,470	32	7,147	3	0	61
Recreational Marine	8,467	1,059	39,795	60	8	4
Light Commercial	4,389	423	55,357	12	1	152
Industrial	1,335	2,690	19,026	4	7	52
Construction	2,716	19,390	14,295	13	91	16
Agricultural	167	595	1,186	1	3	1
Logging	101	133	325	0	0	1
Marine Vessels	ND	ND	ND	0	5	1
Nonroad Engines and Vehicles	30,045	26,919	200,575	136	124	317
Highway Vehicles	ND	ND	ND	415	207	1,470
Other Area and Point Sources	ND	ND	ND	304	169	599
All Sources	NA	NA	NA	855	499	2,386

Boston CMSA Inventory B (in-use est.)
Emission Inventory Summary - VOC, NOx, CO
Percent of Total Inventory

Equipment Category	% total tpy VOC	% total tpy NOx	% total tpy CO	% total tpsd VOC	% total tpsd NOx	% total tpwd CO
Lawn & Garden	NA	NA	NA	4.83%	0.11%	0.85%
Airport Service	NA	NA	NA	0.13%	1.37%	0.42%
Recreational	NA	NA	NA	0.37%	0.00%	2.57%
Recreational Marine	NA	NA	NA	7.01%	1.58%	0.18%
Light Commercial	NA	NA	NA	1.42%	0.23%	6.36%
Industrial	NA	NA	NA	0.44%	1.48%	2.18%
Construction	NA	NA	NA	1.50%	18.30%	0.66%
Agricultural	NA	NA	NA	0.10%	0.65%	0.03%
Logging	NA	NA	NA	0.03%	0.07%	0.04%
Marine Vessels	NA	NA	NA	0.03%	0.99%	0.03%
Nonroad Engines and Vehicles	NA	NA	NA	15.86%	24.79%	13.31%
Highway Vehicles	NA	NA	NA	48.53%	41.44%	61.61%
Other Area and Point Sources	NA	NA	NA	35.61%	33.77%	25.09%
All Sources	NA	NA	NA	100.00%	100.00%	100.00%

Boston CMSA Inventory B (in-use est.)
Emission Inventory Summary - Air Toxics and SOx

Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
	tpy					
Lawn & Garden	128	40	220	92	905	34
Airport Service	181	13	12	6	8	165
Recreational	85	8	131	57	116	3
Recreational Marine	307	77	221	95	1,198	82
Light Commercial	84	30	126	53	351	62
Industrial	116	46	37	16	131	112
Construction	1,676	360	81	42	44	1,683
Agricultural	64	18	4	2	18	46
Logging	15	3	3	1	5	11
Marine Vessels	173	ND	ND	ND	ND	ND
Nonroad Engines and Vehicles	2,830	595	836	364	2,775	2,199
Highway Vehicles	ND	ND	ND	ND	ND	ND
Other Area and Point Sources	ND	ND	ND	ND	ND	ND
All Sources	NA	NA	NA	NA	NA	NA

Boston CMSA Inventory B (in-use est.)
Emission Inventory Summary - Air Toxics and SOx
Percent of Total Inventory

Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
	% total tpy					
Lawn & Garden	NA	NA	NA	NA	NA	NA
Airport Service	NA	NA	NA	NA	NA	NA
Recreational	NA	NA	NA	NA	NA	NA
Recreational Marine	NA	NA	NA	NA	NA	NA
Light Commercial	NA	NA	NA	NA	NA	NA
Industrial	NA	NA	NA	NA	NA	NA
Construction	NA	NA	NA	NA	NA	NA
Agricultural	NA	NA	NA	NA	NA	NA
Logging	NA	NA	NA	NA	NA	NA
Marine Vessels	NA	NA	NA	NA	NA	NA
Nonroad Engines and Vehicles	NA	NA	NA	NA	NA	NA
Highway Vehicles	NA	NA	NA	NA	NA	NA
Other Area and Point Sources	NA	NA	NA	NA	NA	NA
All Sources	NA	NA	NA	NA	NA	NA

Chicago CMSA Inventory B (in-use est.)
Emission Inventory Summary - VOC, NOx, CO

Equipment Category	tpy VOC	tpy NOx	tpy CO	tpsd VOC	tpsd NOx	tpwd CO
Lawn & Garden	13,975	168	98,297	72	1	38
Airport Service	828	5,063	7,355	2	14	20
Recreational	6,806	48	10,696	5	0	93
Recreational Marine	2,865	205	7,385	21	2	0
Light Commercial	7,409	714	93,402	20	2	256
Industrial	2,881	5,608	41,722	8	15	114
Construction	2,245	13,533	13,649	11	64	15
Agricultural	740	3,505	3,094	4	19	2
Logging	136	1	394	0	0	1
Marine Vessels	ND	608	ND	1	26	ND
Nonroad Engines and Vehicles	37,885	29,454	275,994	144	143	539
Highway Vehicles	ND	153,215	ND	588	462	ND
Other Area and Point Sources	ND	302,107	ND	1,029	603	ND
All Sources	NA	484,776	NA	1,761	1,208	NA

Chicago CMSA Inventory B (in-use est.)
Emission Inventory Summary - VOC, NOx, CO
Percent of Total Inventory

Equipment Category	% total tpy VOC	% total tpy NOx	% total tpy CO	% total tpsd VOC	% total tpsd NOx	% total tpwd CO
Lawn & Garden	NA	0.03%	NA	4.10%	0.07%	NA
Airport Service	NA	1.04%	NA	0.13%	1.15%	NA
Recreational	NA	0.01%	NA	0.26%	0.00%	NA
Recreational Marine	NA	0.04%	NA	1.16%	0.13%	NA
Light Commercial	NA	0.15%	NA	1.16%	0.16%	NA
Industrial	NA	1.16%	NA	0.46%	1.27%	NA
Construction	NA	2.79%	NA	0.60%	5.28%	NA
Agricultural	NA	0.72%	NA	0.23%	1.59%	NA
Logging	NA	0.00%	NA	0.02%	0.00%	NA
Marine Vessels	NA	0.13%	NA	0.07%	2.19%	NA
Nonroad Engines and Vehicles	NA	6.08%	NA	8.20%	11.85%	NA
Highway Vehicles	NA	31.61%	NA	33.37%	38.23%	NA
Other Area and Point Sources	NA	62.32%	NA	58.43%	49.92%	NA
All Sources	NA	100.00%	NA	100.00%	100.00%	NA

Chicago CMSA Inventory B (in-use est.)
Emission Inventory Summary - Air Toxics and SOx

Equipment Category	PM	Aldehydes	Benzene	tpy 1,3 But.	Gas. Vap.	SOx
Lawn & Garden	227	70	389	163	1,432	56
Airport Service	366	26	25	12	16	335
Recreational	131	13	200	86	174	5
Recreational Marine	124	15	72	31	491	19
Light Commercial	142	51	213	89	596	105
Industrial	232	96	80	35	284	227
Construction	1,170	267	66	33	85	1,180
Agricultural	390	105	21	11	30	274
Logging	5	1	4	2	7	0
Marine Vessels	300	ND	ND	ND	ND	ND
Nonroad Engines and Vehicles	3,088	643	1,069	462	3,115	2,201
Highway Vehicles	113,525	ND	ND	ND	ND	ND
Other Area and Point Sources	181,246	ND	ND	ND	ND	ND
All Sources	297,859	NA	NA	NA	NA	NA

Chicago CMSA Inventory B (in-use est.)
Emission Inventory Summary - Air Toxics and SOx
Percent of Total Inventory

Equipment Category	PM	Aldehydes	Benzene	% total tpy 1,3 But.	Gas. Vap.	SOx
Lawn & Garden	0.08%	NA	NA	NA	NA	NA
Airport Service	0.12%	NA	NA	NA	NA	NA
Recreational	0.04%	NA	NA	NA	NA	NA
Recreational Marine	0.04%	NA	NA	NA	NA	NA
Light Commercial	0.05%	NA	NA	NA	NA	NA
Industrial	0.08%	NA	NA	NA	NA	NA
Construction	0.39%	NA	NA	NA	NA	NA
Agricultural	0.13%	NA	NA	NA	NA	NA
Logging	0.00%	NA	NA	NA	NA	NA
Marine Vessels	0.10%	NA	NA	NA	NA	NA
Nonroad Engines and Vehicles	1.04%	NA	NA	NA	NA	NA
Highway Vehicles	38.11%	NA	NA	NA	NA	NA
Other Area and Point Sources	60.85%	NA	NA	NA	NA	NA
All Sources	100.00%	NA	NA	NA	NA	NA

Cleveland CMSA Inventory B (in-use est.)
Emission Inventory Summary - VOC, NOx, CO

	tpy			tpsd		tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	7,486	85	55,623	39	0	14
Airport Service	352	2,151	3,118	1	6	9
Recreational	1,031	7	1,620	1	0	14
Recreational Marine	1,242	111	3,962	9	1	0
Light Commercial	2,970	286	37,440	8	1	103
Industrial	1,238	2,470	17,708	4	7	49
Construction	810	5,158	4,841	4	24	5
Agricultural	346	1,576	1,474	2	9	1
Logging	53	8	156	0	0	0
Marine Vessels	1,003	109	3,757	3	0	ND
Nonroad Engines and Vehicles	16,530	11,961	129,698	70	48	195
Highway Vehicles	ND	64,808	412,340	242	195	2,360
Other Area and Point Sources	ND	62,301	88,401	369	171	252
All Sources	NA	139,070	630,439	681	414	2,806

Cleveland CMSA Inventory B (in-use est.)
Emission Inventory Summary - VOC, NOx, CO
Percent of Total Inventory

	% total tpy			% total tpsd		% total tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	NA	0.06%	8.82%	5.76%	0.11%	0.50%
Airport Service	NA	1.55%	0.49%	0.14%	1.42%	0.30%
Recreational	NA	0.01%	0.26%	0.10%	0.00%	0.50%
Recreational Marine	NA	0.08%	0.63%	1.29%	0.21%	0.00%
Light Commercial	NA	0.21%	5.94%	1.20%	0.19%	3.66%
Industrial	NA	1.78%	2.81%	0.52%	1.63%	1.73%
Construction	NA	3.71%	0.77%	0.56%	5.87%	0.19%
Agricultural	NA	1.13%	0.23%	0.28%	2.09%	0.03%
Logging	NA	0.01%	0.02%	0.02%	0.01%	0.02%
Marine Vessels	NA	0.08%	0.60%	0.40%	0.07%	0.00%
Nonroad Engines and Vehicles	NA	8.60%	20.57%	10.27%	11.60%	6.93%
Highway Vehicles	NA	46.60%	65.41%	35.52%	47.17%	84.10%
Other Area and Point Sources	NA	44.80%	14.02%	54.21%	41.23%	8.97%
All Sources	NA	100.00%	100.00%	100.00%	100.00%	100.00%

Cleveland CMSA Inventory B (in-use est.)
Emission Inventory Summary - Air Toxics and SOx

Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
	tpy					
Lawn & Garden	132	39	206	86	854	31
Airport Service	156	11	10	5	7	142
Recreational	20	2	30	13	26	1
Recreational Marine	48	8	30	13	252	9
Light Commercial	57	20	85	36	239	42
Industrial	105	42	34	15	123	102
Construction	435	101	24	12	29	449
Agricultural	176	47	10	5	16	123
Logging	3	0	2	1	3	1
Marine Vessels	ND	ND	ND	ND	ND	ND
Nonroad Engines and Vehicles	1,132	270	432	186	1,549	899
Highway Vehicles	46,729	ND	ND	ND	ND	ND
Other Area and Point Sources	64,287	ND	ND	ND	ND	ND
All Sources	112,148	NA	NA	NA	NA	NA

Cleveland CMSA Inventory B (in-use est.)
Emission Inventory Summary - Air Toxics and SOx
Percent of Total Inventory

Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
	% total tpy					
Lawn & Garden	0.12%	NA	NA	NA	NA	NA
Airport Service	0.14%	NA	NA	NA	NA	NA
Recreational	0.02%	NA	NA	NA	NA	NA
Recreational Marine	0.04%	NA	NA	NA	NA	NA
Light Commercial	0.05%	NA	NA	NA	NA	NA
Industrial	0.09%	NA	NA	NA	NA	NA
Construction	0.39%	NA	NA	NA	NA	NA
Agricultural	0.16%	NA	NA	NA	NA	NA
Logging	0.00%	NA	NA	NA	NA	NA
Marine Vessels	0.00%	NA	NA	NA	NA	NA
Nonroad Engines and Vehicles	1.01%	NA	NA	NA	NA	NA
Highway Vehicles	41.67%	NA	NA	NA	NA	NA
Other Area and Point Sources	57.32%	NA	NA	NA	NA	NA
All Sources	100.00%	NA	NA	NA	NA	NA

Denver CMSA Inventory B (in-use est.)
Emission Inventory Summary - VOC, NOx, CO

	tpy			tpsd		tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	4,473	102	44,042	23	1	14
Airport Service	260	1,591	2,309	1	4	6
Recreational	3,007	21	4,823	2	0	40
Recreational Marine	916	82	2,879	7	1	0
Light Commercial	3,600	380	47,518	10	1	130
Industrial	575	1,182	7,978	2	3	22
Construction	1,017	5,671	6,383	5	27	7
Agricultural	211	1,020	840	1	6	1
Logging	38	1	109	0	0	0
Marine Vessels	ND	ND	0	ND	ND	0
Nonroad Engines and Vehicles	14,096	10,051	116,880	50	42	221
Highway Vehicles	ND	ND	417,406	ND	ND	2,371
Other Area and Point Sources	ND	ND	58,870	ND	ND	168
All Sources	NA	NA	593,156	NA	NA	2,760

Denver CMSA Inventory B (in-use est.)
Emission Inventory Summary - VOC, NOx, CO
Percent of Total Inventory

	% total tpy			% total tpsd		% total tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	NA	NA	7.42%	NA	NA	0.51%
Airport Service	NA	NA	0.39%	NA	NA	0.23%
Recreational	NA	NA	0.81%	NA	NA	1.46%
Recreational Marine	NA	NA	0.49%	NA	NA	0.00%
Light Commercial	NA	NA	8.01%	NA	NA	4.72%
Industrial	NA	NA	1.35%	NA	NA	0.79%
Construction	NA	NA	1.08%	NA	NA	0.25%
Agricultural	NA	NA	0.14%	NA	NA	0.02%
Logging	NA	NA	0.02%	NA	NA	0.01%
Marine Vessels	NA	NA	0.00%	NA	NA	0.00%
Nonroad Engines and Vehicles	NA	NA	19.70%	NA	NA	8.00%
Highway Vehicles	NA	NA	70.37%	NA	NA	85.93%
Other Area and Point Sources	NA	NA	9.92%	NA	NA	6.07%
All Sources	NA	NA	100.00%	NA	NA	100.00%

Denver CMSA Inventory B (in-use est.)
Emission Inventory Summary - Air Toxics and SOx

Equipment Category	PM	Aldehydes	Benzene	tpy 1,3 But.	Gas. Vap.	SOx
Lawn & Garden	76	26	122	51	537	29
Airport Service	115	8	8	4	5	105
Recreational	57	6	88	38	76	2
Recreational Marine	40	6	24	10	114	7
Light Commercial	70	25	103	43	310	55
Industrial	56	20	16	7	52	54
Construction	491	111	30	15	42	498
Agricultural	110	30	6	3	16	80
Logging	2	0	1	0	2	0
Marine Vessels	ND	ND	ND	ND	ND	ND
Nonroad Engines and Vehicles	1,019	232	398	172	1,154	830
Highway Vehicles	32,716	ND	ND	ND	ND	ND
Other Area and Point Sources	146,677	ND	ND	ND	ND	ND
All Sources	180,412	NA	NA	NA	NA	NA

Denver CMSA Inventory B (in-use est.)
Emission Inventory Summary - Air Toxics and SOx
Percent of Total Inventory

Equipment Category	PM	Aldehydes	Benzene	% total tpy 1,3 But.	Gas. Vap.	SOx
Lawn & Garden	0.04%	NA	NA	NA	NA	NA
Airport Service	0.06%	NA	NA	NA	NA	NA
Recreational	0.03%	NA	NA	NA	NA	NA
Recreational Marine	0.02%	NA	NA	NA	NA	NA
Light Commercial	0.04%	NA	NA	NA	NA	NA
Industrial	0.03%	NA	NA	NA	NA	NA
Construction	0.27%	NA	NA	NA	NA	NA
Agricultural	0.06%	NA	NA	NA	NA	NA
Logging	0.00%	NA	NA	NA	NA	NA
Marine Vessels	0.00%	NA	NA	NA	NA	NA
Nonroad Engines and Vehicles	0.56%	NA	NA	NA	NA	NA
Highway Vehicles	18.13%	NA	NA	NA	NA	NA
Other Area and Point Sources	81.30%	NA	NA	NA	NA	NA
All Sources	100.00%	NA	NA	NA	NA	NA

El Paso MSA Inventory B (in-use est.)
Emission Inventory Summary - VOC, NOx, CO

	tpy			tped		tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	1,086	22	10,682	4	0	7
Airport Service	77	470	688	0	1	2
Recreational	333	2	1,036	1	0	1
Recreational Marine	0	0	0	0	0	0
Light Commercial	888	107	12,471	2	0	34
Industrial	276	537	3,860	1	1	11
Construction	296	1,725	1,846	1	6	4
Agricultural	47	205	262	0	1	0
Logging	5	4	16	0	0	0
Marine Vessels	0	0	0	0	0	0
Nonroad Engines and Vehicles	3,009	3,070	30,859	10	10	60
Highway Vehicles	ND	11,156	320,700	36	34	756
Other Area and Point Sources	ND	20,382	18,000	60	25	24
All Sources	NA	34,608	369,559	106	69	840

El Paso MSA Inventory B (in-use est.)
Emission Inventory Summary - VOC, NOx, CO
Percent of Total Inventory

	% total tpy			% total tped		% total tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	NA	0.06%	2.89%	3.76%	0.12%	0.88%
Airport Service	NA	1.36%	0.19%	0.20%	1.87%	0.22%
Recreational	NA	0.01%	0.28%	1.28%	0.01%	0.16%
Recreational Marine	NA	0.00%	0.00%	0.00%	0.00%	0.00%
Light Commercial	NA	0.31%	3.37%	2.30%	0.43%	4.07%
Industrial	NA	1.55%	1.04%	0.74%	2.14%	1.26%
Construction	NA	4.98%	0.50%	1.01%	9.09%	0.48%
Agricultural	NA	0.59%	0.07%	0.17%	1.11%	0.02%
Logging	NA	0.01%	0.00%	0.01%	0.01%	0.01%
Marine Vessels	NA	0.00%	0.00%	0.00%	0.00%	0.00%
Nonroad Engines and Vehicles	NA	8.87%	8.35%	9.46%	14.79%	7.10%
Highway Vehicles	NA	32.24%	86.78%	34.13%	48.98%	90.00%
Other Area and Point Sources	NA	58.89%	4.87%	56.41%	36.23%	2.90%
All Sources	NA	100.00%	100.00%	100.00%	100.00%	100.00%

El Paso MSA Inventory B (in-use est.)
Emission Inventory Summary - Air Toxics and SOx

Equipment Category	PM	Aldehydes	Benzene	tpy 1,3 But.	Gas. Vap.	SOx
Lawn & Garden	20	6	30	13	116	7
Airport Service	34	2	2	1	1	31
Recreational	3	1	9	4	23	0
Recreational Marine	0	0	0	0	0	0
Light Commercial	18	6	25	11	81	15
Industrial	22	9	8	3	27	21
Construction	145	36	9	4	12	154
Agricultural	22	6	1	1	3	16
Logging	0	0	0	0	0	0
Marine Vessels	0	0	ND	ND	ND	0
Nonroad Engines and Vehicles	265	67	85	37	262	245
Highway Vehicles	7,278	ND	ND	ND	ND	ND
Other Area and Point Sources	129,939	ND	ND	ND	ND	ND
All Sources	137,482	NA	NA	NA	NA	NA

El Paso MSA Inventory B (in-use est.)
Emission Inventory Summary - Air Toxics and SOx
Percent of Total Inventory

Equipment Category	PM	Aldehydes	Benzene	% total tpy 1,3 But.	Gas. Vap.	SOx
Lawn & Garden	0.01%	NA	NA	NA	NA	NA
Airport Service	0.02%	NA	NA	NA	NA	NA
Recreational	0.00%	NA	NA	NA	NA	NA
Recreational Marine	0.00%	NA	NA	NA	NA	NA
Light Commercial	0.01%	NA	NA	NA	NA	NA
Industrial	0.02%	NA	NA	NA	NA	NA
Construction	0.11%	NA	NA	NA	NA	NA
Agricultural	0.02%	NA	NA	NA	NA	NA
Logging	0.00%	NA	NA	NA	NA	NA
Marine Vessels	0.00%	NA	NA	NA	NA	NA
Nonroad Engines and Vehicles	0.19%	NA	NA	NA	NA	NA
Highway Vehicles	5.29%	NA	NA	NA	NA	NA
Other Area and Point Sources	94.51%	NA	NA	NA	NA	NA
All Sources	100.00%	NA	NA	NA	NA	NA

Hartford NECMA Inventory B (in-use est.)
Emission Inventory Summary - VOC, NOx, CO

	tpy			tpsd		tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	4,523	41	28,208	24	0	7
Airport Service	294	1,800	2,615	1	5	7
Recreational	1,929	14	3,088	1	0	26
Recreational Marine	2,135	147	6,516	15	1	1
Light Commercial	1,074	104	13,549	3	0	37
Industrial	412	860	5,816	1	2	16
Construction	897	7,522	4,895	4	35	5
Agricultural	120	490	713	1	3	0
Logging	62	33	187	0	0	1
Marine Vessels	11	260	29	0	1	0
Nonroad Engines and Vehicles	11,458	11,271	65,615	51	48	101
Highway Vehicles	ND	29,311	108,380	189	88	590
Other Area and Point Sources	ND	11,650	51,997	77	18	210
All Sources	NA	52,232	225,992	316	154	901

Hartford NECMA Inventory B (in-use est.)
Emission Inventory Summary - VOC, NOx, CO
Percent of Total Inventory

	% total tpy			% total tpsd		% total tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	NA	0.08%	12.48%	7.57%	0.14%	0.75%
Airport Service	NA	3.45%	1.16%	0.28%	3.20%	0.80%
Recreational	NA	0.03%	1.37%	0.43%	0.00%	2.94%
Recreational Marine	NA	0.28%	2.88%	4.85%	0.71%	0.08%
Light Commercial	NA	0.20%	6.00%	0.94%	0.18%	4.12%
Industrial	NA	1.65%	2.57%	0.37%	1.53%	1.77%
Construction	NA	14.40%	2.17%	1.34%	22.98%	0.60%
Agricultural	NA	0.94%	0.32%	0.21%	1.74%	0.05%
Logging	NA	0.06%	0.08%	0.05%	0.06%	0.06%
Marine Vessels	NA	0.50%	0.01%	0.01%	0.46%	0.01%
Nonroad Engines and Vehicles	NA	21.58%	29.03%	16.01%	31.01%	11.16%
Highway Vehicles	NA	56.12%	47.96%	59.66%	57.27%	65.52%
Other Area and Point Sources	NA	22.30%	23.01%	24.32%	11.72%	23.32%
All Sources	NA	100.00%	100.00%	100.00%	100.00%	100.00%

Hartford NECMA Inventory B (in-use est.)
Emission Inventory Summary - Air Toxics and SOx

Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
	tpy					
Lawn & Garden	74	21	126	53	455	15
Airport Service	130	9	9	4	6	119
Recreational	37	4	57	24	50	1
Recreational Marine	95	13	58	25	227	14
Light Commercial	21	7	31	13	86	15
Industrial	41	15	12	5	38	39
Construction	627	138	27	14	16	640
Agricultural	54	15	3	2	8	38
Logging	5	1	2	1	3	3
Marine Vessels	ND	ND	ND	ND	ND	ND
Nonroad Engines and Vehicles	1,084	223	324	141	889	885
Highway Vehicles	ND	ND	ND	ND	ND	ND
Other Area and Point Sources	ND	ND	ND	ND	ND	ND
All Sources	NA	NA	NA	NA	NA	NA

Hartford NECMA Inventory B (in-use est.)
Emission Inventory Summary - Air Toxics and SOx
Percent of Total Inventory

Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
	% total tpy					
Lawn & Garden	NA	NA	NA	NA	NA	NA
Airport Service	NA	NA	NA	NA	NA	NA
Recreational	NA	NA	NA	NA	NA	NA
Recreational Marine	NA	NA	NA	NA	NA	NA
Light Commercial	NA	NA	NA	NA	NA	NA
Industrial	NA	NA	NA	NA	NA	NA
Construction	NA	NA	NA	NA	NA	NA
Agricultural	NA	NA	NA	NA	NA	NA
Logging	NA	NA	NA	NA	NA	NA
Marine Vessels	NA	NA	NA	NA	NA	NA
Nonroad Engines and Vehicles	NA	NA	NA	NA	NA	NA
Highway Vehicles	NA	NA	NA	NA	NA	NA
Other Area and Point Sources	NA	NA	NA	NA	NA	NA
All Sources	NA	NA	NA	NA	NA	NA

Houston CMSA Inventory B (in-use est.)
Emission Inventory Summary - VOC, NOx, CO

	tpy			tped		tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	12,107	181	104,467	44	1	76
Airport Service	448	2,739	3,982	1	8	11
Recreational	1,082	6	3,362	4	0	4
Recreational Marine	13,663	441	32,207	71	2	25
Light Commercial	8,004	963	112,459	22	3	308
Industrial	1,496	2,833	21,205	4	8	58
Construction	3,053	15,789	19,917	11	57	44
Agricultural	656	3,236	2,725	2	12	2
Logging	123	188	437	0	1	1
Marine Vessels	688	12,462	1,718	2	34	5
Nonroad Engines and Vehicles	41,319	38,836	302,479	163	125	534
Highway Vehicles	ND	100,865	ND	442	304	ND
Other Area and Point Sources	ND	440,925	ND	1,391	859	ND
All Sources	NA	580,626	NA	1,996	1,288	NA

Houston CMSA Inventory B (in-use est.)
Emission Inventory Summary - VOC, NOx, CO
Percent of Total Inventory

	% total tpy			% total tped		% total tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	NA	0.03%	NA	2.18%	0.05%	NA
Airport Service	NA	0.47%	NA	0.06%	0.58%	NA
Recreational	NA	0.00%	NA	0.22%	0.00%	NA
Recreational Marine	NA	0.08%	NA	3.58%	0.18%	NA
Light Commercial	NA	0.17%	NA	1.11%	0.20%	NA
Industrial	NA	0.49%	NA	0.21%	0.60%	NA
Construction	NA	2.72%	NA	0.55%	4.43%	NA
Agricultural	NA	0.56%	NA	0.12%	0.94%	NA
Logging	NA	0.03%	NA	0.02%	0.04%	NA
Marine Vessels	NA	2.15%	NA	0.09%	2.65%	NA
Nonroad Engines and Vehicles	NA	6.69%	NA	8.15%	9.68%	NA
Highway Vehicles	NA	17.37%	NA	22.16%	23.60%	NA
Other Area and Point Sources	NA	75.94%	NA	69.68%	66.72%	NA
All Sources	NA	100.00%	NA	100.00%	100.00%	NA

Houston CMSA Inventory B (in-use est.)
Emission Inventory Summary - Air Toxics and SOx

Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
	tpy					
Lawn & Garden	207	67	342	143	1,106	61
Airport Service	198	14	13	7	8	181
Recreational	10	3	31	13	75	1
Recreational Marine	690	61	394	170	624	62
Light Commercial	162	58	229	95	729	138
Industrial	110	48	41	18	151	107
Construction	1,354	314	89	44	134	1,380
Agricultural	359	97	19	10	18	253
Logging	20	4	4	2	6	16
Marine Vessels	741	ND	ND	ND	ND	5,152
Nonroad Engines and Vehicles	3,851	666	1,162	501	2,850	7,350
Highway Vehicles	ND	ND	ND	ND	ND	ND
Other Area and Point Sources	ND	ND	ND	ND	ND	ND
All Sources	NA	NA	NA	NA	NA	NA

Houston CMSA Inventory B (in-use est.)
Emission Inventory Summary - Air Toxics and SOx
Percent of Total Inventory

Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
	% total tpy					
Lawn & Garden	NA	NA	NA	NA	NA	NA
Airport Service	NA	NA	NA	NA	NA	NA
Recreational	NA	NA	NA	NA	NA	NA
Recreational Marine	NA	NA	NA	NA	NA	NA
Light Commercial	NA	NA	NA	NA	NA	NA
Industrial	NA	NA	NA	NA	NA	NA
Construction	NA	NA	NA	NA	NA	NA
Agricultural	NA	NA	NA	NA	NA	NA
Logging	NA	NA	NA	NA	NA	NA
Marine Vessels	NA	NA	NA	NA	NA	NA
Nonroad Engines and Vehicles	NA	NA	NA	NA	NA	NA
Highway Vehicles	NA	NA	NA	NA	NA	NA
Other Area and Point Sources	NA	NA	NA	NA	NA	NA
All Sources	NA	NA	NA	NA	NA	NA

Miami CMSA Inventory B (in-use est.)
Emission Inventory Summary - VOC, NOx, CO

Equipment Category	tpy			tpsd		tpwd
	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	6,620	139	67,127	24	1	46
Airport Service	202	1,239	1,794	1	3	5
Recreational	757	4	2,375	3	0	4
Recreational Marine	3,072	212	8,363	16	1	6
Light Commercial	2,651	309	36,972	7	1	101
Industrial	1,062	1,941	15,267	3	5	42
Construction	1,427	10,146	8,316	5	37	18
Agricultural	202	819	1,235	1	3	1
Logging	29	0	82	0	0	0
Marine Vessels	943	1,310	ND	3	4	ND
Nonroad Engines and Vehicles	16,965	16,119	141,532	63	55	224
Highway Vehicles	ND	63,266	ND	307	191	ND
Other Area and Point Sources	ND	35,464	ND	235	97	ND
All Sources	NA	114,849	NA	604	342	NA

Miami CMSA Inventory B (in-use est.)
Emission Inventory Summary - VOC, NOx, CO
Percent of Total Inventory

Equipment Category	% total tpy			% total tpsd		% total tpwd
	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	NA	0.12%	NA	4.03%	0.15%	NA
Airport Service	NA	1.08%	NA	0.09%	0.99%	NA
Recreational	NA	0.00%	NA	0.48%	0.00%	NA
Recreational Marine	NA	0.18%	NA	2.61%	0.33%	NA
Light Commercial	NA	0.27%	NA	1.21%	0.25%	NA
Industrial	NA	1.69%	NA	0.50%	1.55%	NA
Construction	NA	8.83%	NA	0.85%	10.72%	NA
Agricultural	NA	0.71%	NA	0.13%	0.89%	NA
Logging	NA	0.00%	NA	0.01%	0.00%	NA
Marine Vessels	NA	1.14%	NA	0.43%	1.05%	NA
Nonroad Engines and Vehicles	NA	14.03%	NA	10.35%	15.93%	NA
Highway Vehicles	NA	55.09%	NA	50.77%	55.69%	NA
Other Area and Point Sources	NA	30.88%	NA	38.89%	28.36%	NA
All Sources	NA	100.00%	NA	100.00%	100.00%	NA

Miami CMSA Inventory B (in-use est.)
Emission Inventory Summary - Air Toxics and SOx

Equipment Category	PM	Aldehydes	Benzene	tpy 1,3 But.	Gas. Vap.	SOx
Lawn & Garden	123	40	185	77	682	42
Airport Service	90	6	5	3	4	82
Recreational	7	2	21	9	52	1
Recreational Marine	132	16	78	34	497	20
Light Commercial	53	19	76	31	246	44
Industrial	67	33	29	13	114	66
Construction	839	203	42	21	41	888
Agricultural	90	25	6	3	15	64
Logging	1	0	1	0	2	0
Marine Vessels	ND	ND	ND	ND	ND	ND
Nonroad Engines and Vehicles	1,402	344	444	192	1,651	1,207
Highway Vehicles	ND	ND	ND	ND	ND	ND
Other Area and Point Sources	ND	ND	ND	ND	ND	ND
All Sources	NA	NA	NA	NA	NA	NA

Miami CMSA Inventory B (in-use est.)
Emission Inventory Summary - Air Toxics and SOx
Percent of Total Inventory

Equipment Category	PM	Aldehydes	Benzene	% total tpy 1,3 But.	Gas. Vap.	SOx
Lawn & Garden	NA	NA	NA	NA	NA	NA
Airport Service	NA	NA	NA	NA	NA	NA
Recreational	NA	NA	NA	NA	NA	NA
Recreational Marine	NA	NA	NA	NA	NA	NA
Light Commercial	NA	NA	NA	NA	NA	NA
Industrial	NA	NA	NA	NA	NA	NA
Construction	NA	NA	NA	NA	NA	NA
Agricultural	NA	NA	NA	NA	NA	NA
Logging	NA	NA	NA	NA	NA	NA
Marine Vessels	NA	NA	NA	NA	NA	NA
Nonroad Engines and Vehicles	NA	NA	NA	NA	NA	NA
Highway Vehicles	NA	NA	NA	NA	NA	NA
Other Area and Point Sources	NA	NA	NA	NA	NA	NA
All Sources	NA	NA	NA	NA	NA	NA

Milwaukee CMSA Inventory B (in-use est.)
Emission Inventory Summary - VOC, NOx, CO

	tpy			tped		tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	4,218	50	32,674	22	0	8
Airport Service	193	1,182	1,715	1	3	5
Recreational	1,161	8	1,838	1	0	16
Recreational Marine	1,395	41	2,656	10	0	0
Light Commercial	1,325	128	16,700	4	0	46
Industrial	700	1,358	10,091	2	4	28
Construction	446	2,968	2,712	2	14	3
Agricultural	338	1,560	1,482	2	9	1
Logging	38	0	110	0	0	0
Marine Vessels	457	398	ND	1	1	ND
Nonroad Engines and Vehicles	10,272	7,693	69,979	44	32	106
Highway Vehicles	ND	33,493	ND	108	101	ND
Other Area and Point Sources	ND	39,621	ND	195	109	ND
All Sources	NA	80,807	NA	345	241	NA

Milwaukee CMSA Inventory B (in-use est.)
Emission Inventory Summary - VOC, NOx, CO
Percent of Total Inventory

	% total tpy			% total tped		% total tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	NA	0.06%	NA	6.41%	0.11%	NA
Airport Service	NA	1.46%	NA	0.15%	1.34%	NA
Recreational	NA	0.01%	NA	0.22%	0.00%	NA
Recreational Marine	NA	0.05%	NA	2.88%	0.13%	NA
Light Commercial	NA	0.16%	NA	1.06%	0.15%	NA
Industrial	NA	1.68%	NA	0.58%	1.54%	NA
Construction	NA	3.67%	NA	0.61%	5.80%	NA
Agricultural	NA	1.93%	NA	0.53%	3.55%	NA
Logging	NA	0.00%	NA	0.03%	0.00%	NA
Marine Vessels	NA	0.49%	NA	0.36%	0.45%	NA
Nonroad Engines and Vehicles	NA	9.52%	NA	12.84%	13.08%	NA
Highway Vehicles	NA	41.45%	NA	30.64%	41.88%	NA
Other Area and Point Sources	NA	49.03%	NA	56.53%	45.04%	NA
All Sources	NA	100.00%	NA	100.00%	100.00%	NA

Milwaukee CMSA Inventory B (In-use est.)
Emission Inventory Summary - Air Toxics and SOx

Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
	tpy					
Lawn & Garden	71	22	116	48	498	18
Airport Service	86	6	6	3	4	78
Recreational	22	2	34	15	30	1
Recreational Marine	61	5	34	15	256	6
Light Commercial	25	9	38	16	107	19
Industrial	54	23	19	8	72	52
Construction	260	58	13	7	15	258
Agricultural	175	47	10	5	9	122
Logging	1	0	1	0	2	0
Marine Vessels	ND	ND	ND	ND	ND	ND
Nonroad Engines and Vehicles	756	172	272	117	992	554
Highway Vehicles	ND	ND	ND	ND	ND	ND
Other Area and Point Sources	ND	ND	ND	ND	ND	ND
All Sources	NA	NA	NA	NA	NA	NA

Milwaukee CMSA Inventory B (In-use est.)
Emission Inventory Summary - Air Toxics and SOx
Percent of Total Inventory

Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
	% total tpy					
Lawn & Garden	NA	NA	NA	NA	NA	NA
Airport Service	NA	NA	NA	NA	NA	NA
Recreational	NA	NA	NA	NA	NA	NA
Recreational Marine	NA	NA	NA	NA	NA	NA
Light Commercial	NA	NA	NA	NA	NA	NA
Industrial	NA	NA	NA	NA	NA	NA
Construction	NA	NA	NA	NA	NA	NA
Agricultural	NA	NA	NA	NA	NA	NA
Logging	NA	NA	NA	NA	NA	NA
Marine Vessels	NA	NA	NA	NA	NA	NA
Nonroad Engines and Vehicles	NA	NA	NA	NA	NA	NA
Highway Vehicles	NA	NA	NA	NA	NA	NA
Other Area and Point Sources	NA	NA	NA	NA	NA	NA
All Sources	NA	NA	NA	NA	NA	NA

Minneapolis MSA Inventory B (in-use est.)
Emission Inventory Summary - VOC, NOx, CO

Equipment Category	tpy VOC	tpy NOx	tpy CO	tped VOC	tped NOx	tpwd CO
Lawn & Garden	6,260	75	47,913	33	0	11
Airport Service	299	1,825	2,653	1	5	7
Recreational	1,704	12	2,700	1	0	23
Recreational Marine	7,278	237	16,591	55	2	0
Light Commercial	2,431	234	30,644	7	1	84
Industrial	774	1,607	10,955	2	4	30
Construction	963	5,798	5,640	5	27	6
Agricultural	948	4,406	4,153	5	24	3
Logging	71	5	206	0	0	1
Marine Vessels	ND	ND	28	ND	ND	0
Nonroad Engines and Vehicles	20,727	14,199	121,482	108	64	165
Highway Vehicles	ND	ND	419,140	ND	ND	2.422
Other Area and Point Sources	ND	63,307	125,911	ND	173	357
All Sources	NA	NA	666,533	NA	NA	2,944

Minneapolis MSA Inventory B (in-use est.)
Emission Inventory Summary - VOC, NOx, CO
Percent of Total Inventory

Equipment Category	% total tpy VOC	% total tpy NOx	% total tpy CO	% total tped VOC	% total tped NOx	% total tpwd CO
Lawn & Garden	NA	NA	7.19%	NA	NA	0.39%
Airport Service	NA	NA	0.40%	NA	NA	0.25%
Recreational	NA	NA	0.41%	NA	NA	0.78%
Recreational Marine	NA	NA	2.49%	NA	NA	0.00%
Light Commercial	NA	NA	4.60%	NA	NA	2.85%
Industrial	NA	NA	1.64%	NA	NA	1.02%
Construction	NA	NA	0.85%	NA	NA	0.21%
Agricultural	NA	NA	0.62%	NA	NA	0.09%
Logging	NA	NA	0.03%	NA	NA	0.02%
Marine Vessels	NA	NA	0.00%	NA	NA	0.00%
Nonroad Engines and Vehicles	NA	NA	18.23%	NA	NA	5.61%
Highway Vehicles	NA	NA	62.88%	NA	NA	82.27%
Other Area and Point Sources	NA	NA	18.89%	NA	NA	12.12%
All Sources	NA	NA	100.00%	NA	NA	100.00%

Minneapolis MSA Inventory B (In-use est.)
Emission Inventory Summary - Air Toxics and SOx

Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
	tpy					
Lawn & Garden	99	32	172	72	739	27
Airport Service	132	9	9	4	6	121
Recreational	33	3	50	22	44	1
Recreational Marine	364	32	206	89	444	33
Light Commercial	47	17	70	29	195	34
Industrial	75	28	22	9	72	73
Construction	509	113	28	14	32	508
Agricultural	495	133	28	15	20	344
Logging	3	0	2	1	4	0
Marine Vessels	8	ND	ND	ND	ND	ND
Nonroad Engines and Vehicles	1,765	366	587	255	1,556	1,141
Highway Vehicles	42,282	ND	ND	ND	ND	ND
Other Area and Point Sources	214,398	ND	ND	ND	ND	ND
All Sources	258,445	NA	NA	NA	NA	NA

Minneapolis MSA Inventory B (In-use est.)
Emission Inventory Summary - Air Toxics and SOx
Percent of Total Inventory

Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
	% total tpy					
Lawn & Garden	0.04%	NA	NA	NA	NA	NA
Airport Service	0.05%	NA	NA	NA	NA	NA
Recreational	0.01%	NA	NA	NA	NA	NA
Recreational Marine	0.14%	NA	NA	NA	NA	NA
Light Commercial	0.02%	NA	NA	NA	NA	NA
Industrial	0.03%	NA	NA	NA	NA	NA
Construction	0.20%	NA	NA	NA	NA	NA
Agricultural	0.19%	NA	NA	NA	NA	NA
Logging	0.00%	NA	NA	NA	NA	NA
Marine Vessels	0.00%	NA	NA	NA	NA	NA
Nonroad Engines and Vehicles	0.68%	NA	NA	NA	NA	NA
Highway Vehicles	16.36%	NA	NA	NA	NA	NA
Other Area and Point Sources	82.96%	NA	NA	NA	NA	NA
All Sources	100.00%	NA	NA	NA	NA	NA

New York NECMA Inventory B (In-use est.)
Emission Inventory Summary - VOC, NOx, CO

	tpy			tped		tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	22,825	317	167,607	116	2	83
Airport Service	624	3,818	5,539	2	10	15
Recreational	8,339	59	13,355	5	0	113
Recreational Marine	15,875	1,429	52,027	109	11	6
Light Commercial	20,831	2,008	262,706	57	6	720
Industrial	5,467	10,809	79,009	15	30	216
Construction	5,189	32,106	31,096	24	151	34
Agricultural	804	2,973	5,589	4	16	4
Logging	288	64	846	1	0	2
Marine Vessels	789	12,991	2,458	2	36	7
Nonroad Engines and Vehicles	81,030	66,574	620,232	337	261	1,200
Highway Vehicles	ND	317,257	3,129,400	1,114	956	7,373
Other Area and Point Sources	ND	232,882	546,500	1,578	638	804
All Sources	NA	616,713	4,296,132	3,029	1,855	9,377

New York NECMA Inventory B (In-use est.)
Emission Inventory Summary - VOC, NOx, CO
Percent of Total Inventory

	% total tpy			% total tped		% total tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	NA	0.05%	3.90%	3.83%	0.09%	0.88%
Airport Service	NA	0.62%	0.13%	0.06%	0.56%	0.16%
Recreational	NA	0.01%	0.31%	0.18%	0.00%	1.21%
Recreational Marine	NA	0.23%	1.21%	3.61%	0.57%	0.06%
Light Commercial	NA	0.33%	6.11%	1.90%	0.30%	7.68%
Industrial	NA	1.75%	1.84%	0.51%	1.60%	2.31%
Construction	NA	5.21%	0.72%	0.81%	8.15%	0.36%
Agricultural	NA	0.48%	0.13%	0.14%	0.86%	0.04%
Logging	NA	0.01%	0.02%	0.03%	0.01%	0.02%
Marine Vessels	NA	2.11%	0.06%	0.07%	1.92%	0.07%
Nonroad Engines and Vehicles	NA	10.79%	14.44%	11.13%	14.06%	12.80%
Highway Vehicles	NA	51.44%	72.84%	36.78%	51.53%	78.63%
Other Area and Point Sources	NA	37.76%	12.72%	52.09%	34.39%	8.57%
All Sources	NA	100.00%	100.00%	100.00%	100.00%	100.00%

New York NECMA Inventory B (in-use est.)
Emission Inventory Summary - Air Toxics and SOx

	tpy					
Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
Lawn & Garden	344	115	637	267	2,290	100
Airport Service	276	19	19	9	12	252
Recreational	159	16	244	106	216	6
Recreational Marine	614	102	386	166	3,129	121
Light Commercial	399	142	599	250	1,664	295
Industrial	471	186	152	66	516	459
Construction	2,710	633	152	77	195	2,788
Agricultural	322	90	22	11	83	231
Logging	16	2	8	4	15	6
Marine Vessels	620	ND	ND	ND	ND	4,240
Nonroad Engines and Vehicles	5,932	1,306	2,219	955	8,121	8,497
Highway Vehicles	232,769	ND	ND	ND	ND	ND
Other Area and Point Sources	119,873	ND	ND	ND	ND	ND
All Sources	358,574	NA	NA	NA	NA	NA

New York NECMA Inventory B (in-use est.)
Emission Inventory Summary - Air Toxics and SOx
Percent of Total Inventory

	% total tpy					
Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
Lawn & Garden	0.10%	NA	NA	NA	NA	NA
Airport Service	0.08%	NA	NA	NA	NA	NA
Recreational	0.04%	NA	NA	NA	NA	NA
Recreational Marine	0.17%	NA	NA	NA	NA	NA
Light Commercial	0.11%	NA	NA	NA	NA	NA
Industrial	0.13%	NA	NA	NA	NA	NA
Construction	0.76%	NA	NA	NA	NA	NA
Agricultural	0.09%	NA	NA	NA	NA	NA
Logging	0.00%	NA	NA	NA	NA	NA
Marine Vessels	0.17%	NA	NA	NA	NA	NA
Nonroad Engines and Vehicles	1.65%	NA	NA	NA	NA	NA
Highway Vehicles	64.92%	NA	NA	NA	NA	NA
Other Area and Point Sources	33.43%	NA	NA	NA	NA	NA
All Sources	100.00%	NA	NA	NA	NA	NA

Philedelphia MSA Inventory B (in-use est.)
Emission Inventory Summary - VOC, NOx, CO

	tpy			tped		tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	14,438	210	123,549	57	1	77
Airport Service	317	1,936	2,812	1	5	8
Recreational	2,710	19	4,485	2	0	36
Recreational Marine	4,236	338	12,746	25	2	3
Light Commercial	5,147	544	68,064	14	1	186
Industrial	2,078	3,985	29,695	6	11	81
Construction	2,389	15,258	13,503	10	64	22
Agricultural	815	3,866	3,427	4	17	2
Logging	152	10	440	0	0	1
Marine Vessels	494	9,181	1,377	1	25	4
Nonroad Engines and Vehicles	32,776	35,347	260,099	121	126	421
Highway Vehicles	ND	123,720	568,888	432	373	ND
Other Area and Point Sources	ND	137,579	178,772	911	377	ND
All Sources	NA	296,646	1,007,759	1,463	876	NA

Philedelphia MSA Inventory B (in-use est.)
Emission Inventory Summary - VOC, NOx, CO
Percent of Total Inventory

	% total tpy			% total tped		% total tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	NA	0.07%	12.26%	3.90%	0.10%	NA
Airport Service	NA	0.65%	0.28%	0.06%	0.61%	NA
Recreational	NA	0.01%	0.45%	0.14%	0.00%	NA
Recreational Marine	NA	0.11%	1.26%	1.72%	0.24%	NA
Light Commercial	NA	0.18%	6.75%	0.97%	0.17%	NA
Industrial	NA	1.34%	2.95%	0.40%	1.25%	NA
Construction	NA	5.14%	1.34%	0.68%	7.25%	NA
Agricultural	NA	1.30%	0.34%	0.24%	1.93%	NA
Logging	NA	0.00%	0.04%	0.03%	0.00%	NA
Marine Vessels	NA	3.10%	0.14%	0.09%	2.87%	NA
Nonroad Engines and Vehicles	NA	11.92%	25.81%	8.24%	14.43%	NA
Highway Vehicles	NA	41.71%	56.45%	29.49%	42.55%	NA
Other Area and Point Sources	NA	46.38%	17.74%	62.27%	43.02%	NA
All Sources	NA	100.00%	100.00%	100.00%	100.00%	NA

Philadelphia MSA Inventory B (in-use est.)
Emission Inventory Summary - Air Toxics and SOx

Equipment Category	PM	Aldehydes	Benzene	tpy 1,3 But.	Gas. Vap.	SOx
Lawn & Garden	222	77	397	168	1,666	71
Airport Service	140	10	9	5	6	128
Recreational	51	5	79	34	69	2
Recreational Marine	172	25	105	45	769	30
Light Commercial	100	36	148	61	441	79
Industrial	158	68	58	25	210	154
Construction	1,251	288	70	36	72	1,324
Agricultural	433	116	24	12	31	302
Logging	7	1	4	2	8	1
Marine Vessels	553	ND	ND	ND	ND	4,366
Nonroad Engines and Vehicles	3,088	626	894	387	3,272	6,458
Highway Vehicles	ND	ND	ND	ND	ND	ND
Other Area and Point Sources	ND	ND	ND	ND	ND	ND
All Sources	NA	NA	NA	NA	NA	NA

Philadelphia MSA Inventory B (in-use est.)
Emission Inventory Summary - Air Toxics and SOx
Percent of Total Inventory

Equipment Category	PM	Aldehydes	Benzene	% total tpy 1,3 But.	Gas. Vap.	SOx
Lawn & Garden	NA	NA	NA	NA	NA	NA
Airport Service	NA	NA	NA	NA	NA	NA
Recreational	NA	NA	NA	NA	NA	NA
Recreational Marine	NA	NA	NA	NA	NA	NA
Light Commercial	NA	NA	NA	NA	NA	NA
Industrial	NA	NA	NA	NA	NA	NA
Construction	NA	NA	NA	NA	NA	NA
Agricultural	NA	NA	NA	NA	NA	NA
Logging	NA	NA	NA	NA	NA	NA
Marine Vessels	NA	NA	NA	NA	NA	NA
Nonroad Engines and Vehicles	NA	NA	NA	NA	NA	NA
Highway Vehicles	NA	NA	NA	NA	NA	NA
Other Area and Point Sources	NA	NA	NA	NA	NA	NA
All Sources	NA	NA	NA	NA	NA	NA

Provo-Orem MSA Inventory B (in-use est.)
Emission Inventory Summary - VOC, NOx, CO

	tpy			tped		tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	877	16	7,891	5	0	2
Airport Service	0	0	0	0	0	0
Recreational	627	4	1,006	0	0	8
Recreational Marine	99	12	289	1	0	0
Light Commercial	134	14	1,775	0	0	5
Industrial	36	76	495	0	0	1
Construction	79	587	462	0	3	1
Agricultural	103	478	431	1	3	0
Logging	6	0	18	0	0	0
Marine Vessels	ND	ND	315	ND	ND	1
Nonroad Engines and Vehicles	1,962	1,188	12,683	7	6	18
Highway Vehicles	ND	ND	73,804	ND	ND	440
Other Area and Point Sources	ND	ND	38,273	ND	ND	38
All Sources	NA	NA	124,760	NA	NA	497

Provo-Orem MSA Inventory B (in-use est.)
Emission Inventory Summary - VOC, NOx, CO
Percent of Total Inventory

	% total tpy			% total tped		% total tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	NA	NA	6.32%	NA	NA	0.41%
Airport Service	NA	NA	0.00%	NA	NA	0.00%
Recreational	NA	NA	0.81%	NA	NA	1.70%
Recreational Marine	NA	NA	0.23%	NA	NA	0.00%
Light Commercial	NA	NA	1.42%	NA	NA	0.98%
Industrial	NA	NA	0.40%	NA	NA	0.27%
Construction	NA	NA	0.37%	NA	NA	0.10%
Agricultural	NA	NA	0.35%	NA	NA	0.06%
Logging	NA	NA	0.01%	NA	NA	0.01%
Marine Vessels	NA	NA	0.25%	NA	NA	0.17%
Nonroad Engines and Vehicles	NA	NA	10.17%	NA	NA	3.70%
Highway Vehicles	NA	NA	59.16%	NA	NA	88.58%
Other Area and Point Sources	NA	NA	30.68%	NA	NA	7.72%
All Sources	NA	NA	100.00%	NA	NA	100.00%

Provo-Orem MSA Inventory B (in-use est.)
Emission Inventory Summary - Air Toxics and SOx

	tpy					
Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
Lawn & Garden	16	5	24	10	104	5
Airport Service	0	0	0	0	0	0
Recreational	12	1	18	8	16	0
Recreational Marine	3	1	2	1	34	1
Light Commercial	3	1	4	2	12	2
Industrial	4	1	1	0	3	4
Construction	50	11	2	1	2	52
Agricultural	53	14	3	2	5	37
Logging	0	0	0	0	0	0
Marine Vessels	ND	ND	ND	ND	ND	ND
Nonroad Engines and Vehicles	141	35	55	24	177	101
Highway Vehicles	3,668	ND	ND	ND	ND	ND
Other Area and Point Sources	45,615	ND	ND	ND	ND	ND
All Sources	49,424	NA	NA	NA	NA	NA

Provo-Orem MSA Inventory B (in-use est.)
Emission Inventory Summary - Air Toxics and SOx
Percent of Total Inventory

	% total tpy					
Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
Lawn & Garden	0.03%	NA	NA	NA	NA	NA
Airport Service	0.00%	NA	NA	NA	NA	NA
Recreational	0.02%	NA	NA	NA	NA	NA
Recreational Marine	0.01%	NA	NA	NA	NA	NA
Light Commercial	0.01%	NA	NA	NA	NA	NA
Industrial	0.01%	NA	NA	NA	NA	NA
Construction	0.10%	NA	NA	NA	NA	NA
Agricultural	0.11%	NA	NA	NA	NA	NA
Logging	0.00%	NA	NA	NA	NA	NA
Marine Vessels	0.00%	NA	NA	NA	NA	NA
Nonroad Engines and Vehicles	0.28%	NA	NA	NA	NA	NA
Highway Vehicles	7.42%	NA	NA	NA	NA	NA
Other Area and Point Sources	92.29%	NA	NA	NA	NA	NA
All Sources	100.00%	NA	NA	NA	NA	NA

Saint Louis MSA Inventory B (in-use est.)
Emission Inventory Summary - VOC, NOx, CO

Equipment Category	tpy VOC	tpy NOx	tpy CO	tpsd VOC	tpsd NOx	tpwd CO
Lawn & Garden	8,030	82	55,534	42	0	13
Airport Service	216	1,321	1,921	1	4	5
Recreational	1,522	11	2,411	1	0	21
Recreational Marine	2,869	164	7,904	21	1	0
Light Commercial	2,149	207	27,086	6	1	74
Industrial	908	1,807	13,006	3	5	36
Construction	1,017	6,535	5,867	5	31	6
Agricultural	763	3,646	3,265	4	20	2
Logging	83	1	239	0	0	1
Marine Vessels	2,488	1,820	ND	7	5	ND
Nonroad Engines and Vehicles	20,043	15,594	117,234	89	67	158
Highway Vehicles	ND	62,039	ND	208	187	1,710
Other Area and Point Sources	ND	158,510	ND	360	434	441
All Sources	NA	236,143	NA	657	688	2,309

Saint Louis MSA Inventory B (in-use est.)
Emission Inventory Summary - VOC, NOx, CO
Percent of Total Inventory

Equipment Category	% total tpy VOC	% total tpy NOx	% total tpy CO	% total tpsd VOC	% total tpsd NOx	% total tpwd CO
Lawn & Garden	NA	0.03%	NA	6.44%	0.06%	0.56%
Airport Service	NA	0.56%	NA	0.09%	0.53%	0.23%
Recreational	NA	0.00%	NA	0.15%	0.00%	0.89%
Recreational Marine	NA	0.07%	NA	3.20%	0.18%	0.00%
Light Commercial	NA	0.09%	NA	0.90%	0.08%	3.21%
Industrial	NA	0.77%	NA	0.39%	0.72%	1.54%
Construction	NA	2.77%	NA	0.73%	4.48%	0.28%
Agricultural	NA	1.54%	NA	0.63%	2.90%	0.09%
Logging	NA	0.00%	NA	0.03%	0.00%	0.03%
Marine Vessels	NA	0.77%	NA	1.04%	0.72%	0.00%
Nonroad Engines and Vehicles	NA	6.60%	NA	13.62%	9.68%	6.84%
Highway Vehicles	NA	26.27%	NA	31.60%	27.18%	74.05%
Other Area and Point Sources	NA	67.12%	NA	54.78%	63.13%	19.11%
All Sources	NA	100.00%	NA	100.00%	100.00%	100.00%

Saint Louis MSA Inventory B (in-use est.)
Emission Inventory Summary - Air Toxics and SOx

Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
	tpy					
Lawn & Garden	131	40	224	94	833	30
Airport Service	96	7	6	3	4	87
Recreational	29	3	45	19	39	1
Recreational Marine	129	15	77	33	339	17
Light Commercial	41	15	62	26	173	30
Industrial	77	31	25	11	90	75
Construction	546	129	30	15	34	572
Agricultural	409	110	22	12	15	285
Logging	3	0	2	1	4	0
Marine Vessels	184	ND	ND	ND	ND	ND
Nonroad Engines and Vehicles	1,645	349	493	214	1,532	1,097
Highway Vehicles	38,099	ND	ND	ND	ND	ND
Other Area and Point Sources	89,636	ND	ND	ND	ND	ND
All Sources	129,380	NA	NA	NA	NA	NA

Saint Louis MSA Inventory B (in-use est.)
Emission Inventory Summary - Air Toxics and SOx
Percent of Total Inventory

Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
	% total tpy					
Lawn & Garden	0.10%	NA	NA	NA	NA	NA
Airport Service	0.07%	NA	NA	NA	NA	NA
Recreational	0.02%	NA	NA	NA	NA	NA
Recreational Marine	0.10%	NA	NA	NA	NA	NA
Light Commercial	0.03%	NA	NA	NA	NA	NA
Industrial	0.06%	NA	NA	NA	NA	NA
Construction	0.42%	NA	NA	NA	NA	NA
Agricultural	0.32%	NA	NA	NA	NA	NA
Logging	0.00%	NA	NA	NA	NA	NA
Marine Vessels	0.14%	NA	NA	NA	NA	NA
Nonroad Engines and Vehicles	1.27%	NA	NA	NA	NA	NA
Highway Vehicles	29.45%	NA	NA	NA	NA	NA
Other Area and Point Sources	69.28%	NA	NA	NA	NA	NA
All Sources	100.00%	NA	NA	NA	NA	NA

San Diego AB Inventory B (in-use est.)
Emission Inventory Summary - VOC, NOx, CO

Equipment Category	tpy VOC	tpy NOx	tpy CO	tpsd VOC	tpsd NOx	tpwd CO
Lawn & Garden	5,284	154	62,675	19	1	46
Airport Service	235	1,439	2,092	1	4	6
Recreational	1,363	8	4,225	6	0	6
Recreational Marine	2,230	270	8,157	11	1	6
Light Commercial	1,657	199	23,281	5	1	64
Industrial	613	1,181	8,606	2	3	24
Construction	1,223	6,533	7,865	4	24	17
Agricultural	286	1,247	1,571	1	5	1
Logging	66	0	191	0	0	1
Marine Vessels	ND	ND	ND	3	41	7
Nonroad Engines and Vehicles	12,957	11,031	118,663	51	79	177
Highway Vehicles	ND	47,136	570,100	130	142	1,343
Other Area and Point Sources	ND	ND	94,000	271	34	154
All Sources	NA	NA	782,763	451	255	1,674

San Diego AB Inventory B (in-use est.)
Emission Inventory Summary - VOC, NOx, CO
Percent of Total Inventory

Equipment Category	% total tpy VOC	% total tpy NOx	% total tpy CO	% total tpsd VOC	% total tpsd NOx	% total tpwd CO
Lawn & Garden	NA	NA	8.01%	4.15%	0.22%	2.75%
Airport Service	NA	NA	0.27%	0.14%	1.54%	0.34%
Recreational	NA	NA	0.54%	1.23%	0.01%	0.36%
Recreational Marine	NA	NA	1.04%	2.48%	0.56%	0.37%
Light Commercial	NA	NA	2.97%	1.01%	0.21%	3.81%
Industrial	NA	NA	1.10%	0.38%	1.27%	1.41%
Construction	NA	NA	1.00%	0.98%	9.25%	1.03%
Agricultural	NA	NA	0.20%	0.24%	1.82%	0.06%
Logging	NA	NA	0.02%	0.04%	0.00%	0.03%
Marine Vessels	NA	NA	0.00%	0.55%	16.10%	0.40%
Nonroad Engines and Vehicles	NA	NA	15.16%	11.22%	31.00%	10.57%
Highway Vehicles	NA	NA	72.83%	28.74%	55.65%	80.25%
Other Area and Point Sources	NA	NA	12.01%	60.04%	13.36%	9.18%
All Sources	NA	NA	100.00%	100.00%	100.00%	100.00%

San Diego AB Inventory B (in-use est.)
Emission Inventory Summary - Air Toxics and SOx

	tpy					
Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
Lawn & Garden	77	32	146	61	586	42
Airport Service	104	7	7	3	4	95
Recreational	13	4	38	16	95	2
Recreational Marine	73	16	48	21	637	21
Light Commercial	33	12	47	20	151	29
Industrial	48	20	17	7	60	47
Construction	568	129	36	18	50	570
Agricultural	139	38	8	4	14	97
Logging	3	0	2	1	4	0
Marine Vessels	854	ND	ND	ND	ND	6,979
Nonroad Engines and Vehicles	1,911	259	350	152	1,602	7,881
Highway Vehicles	6,935	ND	ND	ND	ND	2,409
Other Area and Point Sources	179,215	ND	ND	ND	ND	3,723
All Sources	188,061	NA	NA	NA	NA	14,013

San Diego AB Inventory B (in-use est.)
Emission Inventory Summary - Air Toxics and SOx
Percent of Total Inventory

	% total tpy					
Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
Lawn & Garden	0.04%	NA	NA	NA	NA	0.30%
Airport Service	0.06%	NA	NA	NA	NA	0.68%
Recreational	0.01%	NA	NA	NA	NA	0.01%
Recreational Marine	0.04%	NA	NA	NA	NA	0.15%
Light Commercial	0.02%	NA	NA	NA	NA	0.20%
Industrial	0.03%	NA	NA	NA	NA	0.33%
Construction	0.30%	NA	NA	NA	NA	4.07%
Agricultural	0.07%	NA	NA	NA	NA	0.69%
Logging	0.00%	NA	NA	NA	NA	0.00%
Marine Vessels	0.45%	NA	NA	NA	NA	49.80%
Nonroad Engines and Vehicles	1.02%	NA	NA	NA	NA	56.24%
Highway Vehicles	3.69%	NA	NA	NA	NA	17.19%
Other Area and Point Sources	95.30%	NA	NA	NA	NA	26.57%
All Sources	100.00%	NA	NA	NA	NA	100.00%

San Joaquin AB Inventory B (in-use est.)
Emission Inventory Summary - VOC, NOx, CO

Equipment Category	tpy VOC	tpy NOx	tpy CO	tpsd VOC	tpsd NOx	tpwd CO
Lawn & Garden	6,366	96	46,980	22	0	41
Airport Service	27	163	241	0	0	1
Recreational	278	2	861	1	0	1
Recreational Marine	423	78	1,614	2	0	1
Light Commercial	1,745	210	24,511	5	1	67
Industrial	376	1,008	4,673	1	3	13
Construction	1,119	6,586	6,830	4	24	15
Agricultural	3,664	17,943	15,411	14	67	10
Logging	140	73	442	0	0	1
Marine Vessels	ND	ND	ND	0	3	0
Nonroad Engines and Vehicles	14,137	26,158	101,563	49	98	150
Highway Vehicles	ND	ND	ND	150	240	1,100
Other Area and Point Sources	ND	ND	ND	1,022	249	683
All Sources	NA	NA	NA	1,221	587	1,934

San Joaquin AB Inventory B (in-use est.)
Emission Inventory Summary - VOC, NOx, CO
Percent of Total Inventory

Equipment Category	% total tpy VOC	% total tpy NOx	% total tpy CO	% total tpsd VOC	% total tpsd NOx	% total tpwd CO
Lawn & Garden	NA	NA	NA	1.77%	0.06%	2.10%
Airport Service	NA	NA	NA	0.01%	0.08%	0.03%
Recreational	NA	NA	NA	0.11%	0.00%	0.06%
Recreational Marine	NA	NA	NA	0.17%	0.07%	0.06%
Light Commercial	NA	NA	NA	0.39%	0.10%	3.47%
Industrial	NA	NA	NA	0.09%	0.47%	0.66%
Construction	NA	NA	NA	0.33%	4.08%	0.77%
Agricultural	NA	NA	NA	1.12%	11.39%	0.52%
Logging	NA	NA	NA	0.03%	0.03%	0.06%
Marine Vessels	NA	NA	NA	0.02%	0.45%	0.02%
Nonroad Engines and Vehicles	NA	NA	NA	4.03%	16.71%	7.77%
Highway Vehicles	NA	NA	NA	12.28%	40.90%	56.89%
Other Area and Point Sources	NA	NA	NA	83.69%	42.38%	35.33%
All Sources	NA	NA	NA	100.00%	100.00%	100.00%

San Joaquin AB Inventory B (in-use est.)
Emission Inventory Summary - Air Toxics and SOx

	tpy					
Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
Lawn & Garden	83	30	180	75	580	29
Airport Service	12	1	1	0	0	11
Recreational	3	1	8	3	19	0
Recreational Marine	9	3	7	3	207	5
Light Commercial	35	13	50	21	159	30
Industrial	54	16	11	5	32	50
Construction	556	128	33	16	40	576
Agricultural	1,978	536	107	57	90	1,404
Logging	11	2	4	2	8	6
Marine Vessels	62	ND	ND	ND	ND	402
Nonroad Engines and Vehicles	2,803	730	400	182	1,135	2,513
Highway Vehicles	13,505	ND	ND	ND	ND	9,125
Other Area and Point Sources	731,789	ND	ND	ND	ND	16,790
All Sources	748,097	NA	NA	NA	NA	28,428

San Joaquin AB Inventory B (in-use est.)
Emission Inventory Summary - Air Toxics and SOx
Percent of Total Inventory

	% total tpy					
Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
Lawn & Garden	0.01%	NA	NA	NA	NA	0.10%
Airport Service	0.00%	NA	NA	NA	NA	0.04%
Recreational	0.00%	NA	NA	NA	NA	0.00%
Recreational Marine	0.00%	NA	NA	NA	NA	0.02%
Light Commercial	0.00%	NA	NA	NA	NA	0.11%
Industrial	0.01%	NA	NA	NA	NA	0.17%
Construction	0.07%	NA	NA	NA	NA	2.03%
Agricultural	0.26%	NA	NA	NA	NA	4.94%
Logging	0.00%	NA	NA	NA	NA	0.02%
Marine Vessels	0.01%	NA	NA	NA	NA	1.41%
Nonroad Engines and Vehicles	0.37%	NA	NA	NA	NA	8.84%
Highway Vehicles	1.81%	NA	NA	NA	NA	32.10%
Other Area and Point Sources	97.82%	NA	NA	NA	NA	59.06%
All Sources	100.00%	NA	NA	NA	NA	100.00%

Seattle-Tacoma MSA Inventory B (in-use est.)
Emission Inventory Summary - VOC, NOx, CO

	tpy			tpsd		tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	9,396	113	72,556	38	0	33
Airport Service	212	1,295	1,885	1	4	5
Recreational	1,080	7	2,695	3	0	9
Recreational Marine	5,014	406	12,228	30	3	7
Light Commercial	1,923	224	26,721	5	1	73
Industrial	873	1,617	12,482	2	4	34
Construction	1,078	6,115	6,942	4	25	11
Agricultural	268	1,275	1,110	1	6	1
Logging	157	587	844	0	2	2
Marine Vessels	2,194	17,253	31,940	6	47	88
Nonroad Engines and Vehicles	22,194	28,891	169,403	92	92	263
Highway Vehicles	ND	ND	267,670	ND	ND	1,515
Other Area and Point Sources	ND	ND	199,979	ND	ND	565
All Sources	NA	NA	637,052	NA	NA	2,343

Seattle-Tacoma MSA Inventory B (in-use est.)
Emission Inventory Summary - VOC, NOx, CO
Percent of Total Inventory

	% total tpy			% total tpsd		% total tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	NA	NA	11.39%	NA	NA	1.42%
Airport Service	NA	NA	0.30%	NA	NA	0.22%
Recreational	NA	NA	0.42%	NA	NA	0.37%
Recreational Marine	NA	NA	1.92%	NA	NA	0.29%
Light Commercial	NA	NA	4.19%	NA	NA	3.12%
Industrial	NA	NA	1.96%	NA	NA	1.46%
Construction	NA	NA	1.09%	NA	NA	0.49%
Agricultural	NA	NA	0.17%	NA	NA	0.03%
Logging	NA	NA	0.13%	NA	NA	0.10%
Marine Vessels	NA	NA	5.01%	NA	NA	3.73%
Nonroad Engines and Vehicles	NA	NA	26.59%	NA	NA	11.24%
Highway Vehicles	NA	NA	42.02%	NA	NA	64.65%
Other Area and Point Sources	NA	NA	31.39%	NA	NA	24.11%
All Sources	NA	NA	100.00%	NA	NA	100.00%

Seattle-Tacoma MSA Inventory B (in-use est.)
Emission Inventory Summary - Air Toxics and SOx

Equipment Category	PM	Aldehydes	Benzene	tpy 1,3 But.	Gas. Vap.	SOx
Lawn & Garden	162	49	264	111	893	40
Airport Service	94	7	6	3	4	86
Recreational	14	3	31	13	60	1
Recreational Marine	215	24	122	52	994	37
Light Commercial	38	14	55	23	178	32
Industrial	59	27	24	10	92	58
Construction	522	116	32	16	44	528
Agricultural	142	38	8	4	12	100
Logging	53	11	5	2	9	49
Marine Vessels	1,017	ND	ND	ND	ND	7,576
Nonroad Engines and Vehicles	2,316	289	546	234	2,285	8,506
Highway Vehicles	30,151	ND	ND	ND	ND	ND
Other Area and Point Sources	37,878	ND	ND	ND	ND	ND
All Sources	70,345	NA	NA	NA	NA	NA

Seattle-Tacoma MSA Inventory B (in-use est.)
Emission Inventory Summary - Air Toxics and SOx
Percent of Total Inventory

Equipment Category	PM	Aldehydes	Benzene	% total tpy 1,3 But.	Gas. Vap.	SOx
Lawn & Garden	0.23%	NA	NA	NA	NA	NA
Airport Service	0.13%	NA	NA	NA	NA	NA
Recreational	0.02%	NA	NA	NA	NA	NA
Recreational Marine	0.31%	NA	NA	NA	NA	NA
Light Commercial	0.05%	NA	NA	NA	NA	NA
Industrial	0.08%	NA	NA	NA	NA	NA
Construction	0.74%	NA	NA	NA	NA	NA
Agricultural	0.20%	NA	NA	NA	NA	NA
Logging	0.08%	NA	NA	NA	NA	NA
Marine Vessels	1.45%	NA	NA	NA	NA	NA
Nonroad Engines and Vehicles	3.29%	NA	NA	NA	NA	NA
Highway Vehicles	42.86%	NA	NA	NA	NA	NA
Other Area and Point Sources	53.85%	NA	NA	NA	NA	NA
All Sources	100.00%	NA	NA	NA	NA	NA

South Coast AB Inventory B (in-use est.)
Emission Inventory Summary - VOC, NOx, CO

	tpy			tpsd		tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	19,230	438	200,769	67	2	152
Airport Service	890	5,447	7,911	2	15	22
Recreational	4,932	28	15,313	20	0	22
Recreational Marine	6,729	835	24,793	34	4	19
Light Commercial	13,340	1,605	187,411	37	4	513
Industrial	4,680	12,389	58,709	13	34	161
Construction	5,582	28,606	35,942	20	103	79
Agricultural	794	2,979	5,504	3	11	4
Logging	277	29	816	1	0	2
Marine Vessels	ND	ND	ND	7	68	10
Nonroad Engines and Vehicles	56,453	52,355	537,169	205	242	984
Highway Vehicles	ND	ND	ND	650	660	9,732
Other Area and Point Sources	ND	ND	ND	1,400	334	265
All Sources	NA	NA	NA	2,255	1,236	10,981

South Coast AB Inventory B (in-use est.)
Emission Inventory Summary - VOC, NOx, CO
Percent of Total Inventory

	% total tpy			% total tpsd		% total tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	NA	NA	NA	2.98%	0.13%	1.38%
Airport Service	NA	NA	NA	0.11%	1.21%	0.20%
Recreational	NA	NA	NA	0.89%	0.01%	0.20%
Recreational Marine	NA	NA	NA	1.50%	0.36%	0.17%
Light Commercial	NA	NA	NA	1.63%	0.36%	4.68%
Industrial	NA	NA	NA	0.58%	2.75%	1.46%
Construction	NA	NA	NA	0.90%	8.37%	0.72%
Agricultural	NA	NA	NA	0.13%	0.90%	0.03%
Logging	NA	NA	NA	0.03%	0.01%	0.02%
Marine Vessels	NA	NA	NA	0.32%	5.53%	0.10%
Nonroad Engines and Vehicles	NA	NA	NA	9.09%	19.61%	8.96%
Highway Vehicles	NA	NA	NA	28.83%	53.39%	88.63%
Other Area and Point Sources	NA	NA	NA	62.09%	27.00%	2.41%
All Sources	NA	NA	NA	100.00%	100.00%	100.00%

South Coast AB Inventory B (in-use est.)
Emission Inventory Summary - Air Toxics and SOx

				tpy		
Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
Lawn & Garden	266	112	548	230	1,551	128
Airport Service	394	28	26	13	16	360
Recreational	46	14	139	60	344	6
Recreational Marine	215	49	144	62	1,980	64
Light Commercial	270	96	382	158	1,218	230
Industrial	659	202	132	59	391	612
Construction	2,447	564	163	81	239	2,495
Agricultural	324	90	21	11	81	231
Logging	13	2	8	3	15	3
Marine Vessels	1,515	ND	ND	ND	ND	12,797
Nonroad Engines and Vehicles	6,148	1,158	1,563	676	5,835	16,925
Highway Vehicles	34,675	ND	ND	ND	ND	11,680
Other Area and Point Sources	766,500	ND	ND	ND	ND	18,214
All Sources	807,323	NA	NA	NA	NA	46,818

South Coast AB Inventory B (in-use est.)
Emission Inventory Summary - Air Toxics and SOx
Percent of Total Inventory

				% total tpy		
Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
Lawn & Garden	0.03%	NA	NA	NA	NA	0.27%
Airport Service	0.05%	NA	NA	NA	NA	0.77%
Recreational	0.01%	NA	NA	NA	NA	0.01%
Recreational Marine	0.03%	NA	NA	NA	NA	0.14%
Light Commercial	0.03%	NA	NA	NA	NA	0.49%
Industrial	0.08%	NA	NA	NA	NA	1.31%
Construction	0.30%	NA	NA	NA	NA	5.33%
Agricultural	0.04%	NA	NA	NA	NA	0.49%
Logging	0.00%	NA	NA	NA	NA	0.01%
Marine Vessels	0.19%	NA	NA	NA	NA	27.33%
Nonroad Engines and Vehicles	0.76%	NA	NA	NA	NA	36.15%
Highway Vehicles	4.30%	NA	NA	NA	NA	24.95%
Other Area and Point Sources	94.94%	NA	NA	NA	NA	38.90%
All Sources	100.00%	NA	NA	NA	NA	100.00%

Springfield MSA Inventory B (in-use est.)
Emission Inventory Summary - VOC, NOx, CO

Equipment Category	tpy VOC	tpy NOx	tpy CO	tpsd VOC	tpsd NOx	tpwd CO
Lawn & Garden	1,676	20	11,574	9	0	3
Airport Service	0	0	0	0	0	0
Recreational	798	6	1,276	1	0	11
Recreational Marine	561	60	2,183	4	0	0
Light Commercial	503	49	6,350	1	0	17
Industrial	210	413	3,015	1	1	8
Construction	199	1,448	1,110	1	7	1
Agricultural	82	352	431	0	2	0
Logging	21	31	69	0	0	0
Marine Vessels	0	0	0	0	0	ND
Nonroad Engines and Vehicles	4,050	2,379	26,008	17	11	42
Highway Vehicles	ND	ND	ND	62	30	ND
Other Area and Point Sources	ND	ND	ND	50	30	ND
All Sources	NA	NA	NA	129	71	NA

Springfield MSA Inventory B (in-use est.)
Emission Inventory Summary - VOC, NOx, CO
Percent of Total Inventory

Equipment Category	% total tpy VOC	% total tpy NOx	% total tpy CO	% total tpsd VOC	% total tpsd NOx	% total tpwd CO
Lawn & Garden	NA	NA	NA	6.83%	0.16%	NA
Airport Service	NA	NA	NA	0.00%	0.00%	NA
Recreational	NA	NA	NA	0.43%	0.00%	NA
Recreational Marine	NA	NA	NA	2.97%	0.64%	NA
Light Commercial	NA	NA	NA	1.06%	0.19%	NA
Industrial	NA	NA	NA	0.46%	1.59%	NA
Construction	NA	NA	NA	0.73%	9.62%	NA
Agricultural	NA	NA	NA	0.34%	2.72%	NA
Logging	NA	NA	NA	0.05%	0.12%	NA
Marine Vessels	NA	NA	NA	0.00%	0.00%	NA
Nonroad Engines and Vehicles	NA	NA	NA	12.90%	15.03%	NA
Highway Vehicles	NA	NA	NA	48.53%	42.70%	NA
Other Area and Point Sources	NA	NA	NA	38.56%	42.26%	NA
All Sources	NA	NA	NA	100.00%	100.00%	NA

Springfield MSA Inventory B (In-use est.)
Emission Inventory Summary - Air Toxics and SOx

Equipment Category	PM	Aldehydes	Benzene	tpy 1,3 But.	Gas. Vap.	SOx
Lawn & Garden	28	8	46	19	185	7
Airport Service	0	0	0	0	0	0
Recreational	15	1	23	10	21	1
Recreational Marine	19	4	13	6	126	5
Light Commercial	10	3	14	6	40	7
Industrial	17	7	6	3	21	17
Construction	121	27	6	3	5	125
Agricultural	39	11	2	1	4	27
Logging	3	1	1	0	1	3
Marine Vessels	0	0	ND	ND	ND	0
Nonroad Engines and Vehicles	253	63	112	48	402	191
Highway Vehicles	ND	ND	ND	ND	ND	ND
Other Area and Point Sources	ND	ND	ND	ND	ND	ND
All Sources	NA	NA	NA	NA	NA	NA

Springfield MSA Inventory B (In-use est.)
Emission Inventory Summary - Air Toxics and SOx
Percent of Total Inventory

Equipment Category	PM	Aldehydes	Benzene	% total tpy 1,3 But.	Gas. Vap.	SOx
Lawn & Garden	NA	NA	NA	NA	NA	NA
Airport Service	NA	NA	NA	NA	NA	NA
Recreational	NA	NA	NA	NA	NA	NA
Recreational Marine	NA	NA	NA	NA	NA	NA
Light Commercial	NA	NA	NA	NA	NA	NA
Industrial	NA	NA	NA	NA	NA	NA
Construction	NA	NA	NA	NA	NA	NA
Agricultural	NA	NA	NA	NA	NA	NA
Logging	NA	NA	NA	NA	NA	NA
Marine Vessels	NA	NA	NA	NA	NA	NA
Nonroad Engines and Vehicles	NA	NA	NA	NA	NA	NA
Highway Vehicles	NA	NA	NA	NA	NA	NA
Other Area and Point Sources	NA	NA	NA	NA	NA	NA
All Sources	NA	NA	NA	NA	NA	NA

Spokane MSA Inventory B (in-use est.)
Emission Inventory Summary - VOC, NOx, CO

Equipment Category	tpy VOC	tpy NOx	tpy CO	tpsd VOC	tpsd NOx	tpwd CO
Lawn & Garden	1,773	18	12,087	10	0	0
Airport Service	29	178	265	0	0	1
Recreational	199	1	480	1	0	1
Recreational Marine	321	12	669	2	0	0
Light Commercial	302	32	3,983	1	0	11
Industrial	72	136	1,030	0	0	3
Construction	110	693	648	1	3	1
Agricultural	141	644	628	1	4	0
Logging	17	16	52	0	0	0
Marine Vessels	ND	ND	245	ND	ND	1
Nonroad Engines and Vehicles	2,964	1,730	20,087	15	8	18
Highway Vehicles	ND	ND	9,026	ND	ND	251
Other Area and Point Sources	ND	ND	77,748	ND	ND	224
All Sources	NA	NA	106,861	NA	NA	493

Spokane MSA Inventory B (in-use est.)
Emission Inventory Summary - VOC, NOx, CO
Percent of Total Inventory

Equipment Category	% total tpy VOC	% total tpy NOx	% total tpy CO	% total tpsd VOC	% total tpsd NOx	% total tpwd CO
Lawn & Garden	NA	NA	11.31%	NA	NA	0.03%
Airport Service	NA	NA	0.25%	NA	NA	0.15%
Recreational	NA	NA	0.45%	NA	NA	0.29%
Recreational Marine	NA	NA	0.63%	NA	NA	0.00%
Light Commercial	NA	NA	3.73%	NA	NA	2.21%
Industrial	NA	NA	0.96%	NA	NA	0.57%
Construction	NA	NA	0.61%	NA	NA	0.14%
Agricultural	NA	NA	0.59%	NA	NA	0.08%
Logging	NA	NA	0.05%	NA	NA	0.03%
Marine Vessels	NA	NA	0.23%	NA	NA	0.14%
Nonroad Engines and Vehicles	NA	NA	18.80%	NA	NA	3.65%
Highway Vehicles	NA	NA	8.45%	NA	NA	50.95%
Other Area and Point Sources	NA	NA	72.76%	NA	NA	45.39%
All Sources	NA	NA	100.00%	NA	NA	100.00%

Spokane MSA Inventory B (in-use est.)
Emission Inventory Summary - Air Toxics and SOx

	tpy					
Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
Lawn & Garden	34	9	50	21	175	7
Airport Service	13	1	1	0	1	12
Recreational	3	0	6	2	12	0
Recreational Marine	16	1	9	4	26	2
Light Commercial	6	2	9	4	26	5
Industrial	5	2	2	1	7	5
Construction	58	13	3	2	4	60
Agricultural	72	19	4	2	4	50
Logging	2	0	0	0	1	1
Marine Vessels	ND	ND	ND	ND	ND	ND
Nonroad Engines and Vehicles	209	49	84	36	256	142
Highway Vehicles	3,881	ND	ND	ND	ND	ND
Other Area and Point Sources	9,837	ND	ND	ND	ND	ND
All Sources	13,927	NA	NA	NA	NA	NA

Spokane MSA Inventory B (in-use est.)
Emission Inventory Summary - Air Toxics and SOx
Percent of Total Inventory

	% total tpy					
Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
Lawn & Garden	0.24%	NA	NA	NA	NA	NA
Airport Service	0.09%	NA	NA	NA	NA	NA
Recreational	0.02%	NA	NA	NA	NA	NA
Recreational Marine	0.11%	NA	NA	NA	NA	NA
Light Commercial	0.04%	NA	NA	NA	NA	NA
Industrial	0.04%	NA	NA	NA	NA	NA
Construction	0.42%	NA	NA	NA	NA	NA
Agricultural	0.52%	NA	NA	NA	NA	NA
Logging	0.01%	NA	NA	NA	NA	NA
Marine Vessels	0.00%	NA	NA	NA	NA	NA
Nonroad Engines and Vehicles	1.50%	NA	NA	NA	NA	NA
Highway Vehicles	27.87%	NA	NA	NA	NA	NA
Other Area and Point Sources	70.63%	NA	NA	NA	NA	NA
All Sources	100.00%	NA	NA	NA	NA	NA

Washington DC MSA Inventory B (in-use est.)
Emission Inventory Summary - VOC, NOx, CO

	tpy			tpsd		tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	16,969	360	216,929	70	2	88
Airport Service	423	2,589	3,763	1	7	10
Recreational	1,421	9	3,016	3	0	15
Recreational Marine	1,850	143	5,777	11	1	1
Light Commercial	2,156	228	28,516	6	1	78
Industrial	572	1,054	8,288	2	3	23
Construction	1,932	12,043	11,235	8	50	18
Agricultural	552	2,421	2,935	2	11	2
Logging	153	25	448	0	0	1
Marine Vessels	806	227	2,820	2	1	8
Nonroad Engines and Vehicles	26,834	19,099	283,726	105	75	244
Highway Vehicles	ND	83,068	398,686	345	250	2,161
Other Area and Point Sources	ND	88,336	59,024	202	242	167
All Sources	NA	190,503	741,436	652	567	2,572

Washington DC MSA Inventory B (in-use est.)
Emission Inventory Summary - VOC, NOx, CO
Percent of Total Inventory

	% total tpy			% total tpsd		% total tpwd
Equipment Category	VOC	NOx	CO	VOC	NOx	CO
Lawn & Garden	NA	0.19%	29.26%	10.69%	0.28%	3.42%
Airport Service	NA	1.36%	0.51%	0.18%	1.25%	0.40%
Recreational	NA	0.00%	0.41%	0.43%	0.00%	0.57%
Recreational Marine	NA	0.08%	0.78%	1.69%	0.16%	0.05%
Light Commercial	NA	0.12%	3.85%	0.91%	0.11%	3.04%
Industrial	NA	0.55%	1.12%	0.25%	0.51%	0.88%
Construction	NA	6.32%	1.52%	1.23%	8.85%	0.72%
Agricultural	NA	1.27%	0.40%	0.37%	1.87%	0.08%
Logging	NA	0.01%	0.06%	0.06%	0.01%	0.05%
Marine Vessels	NA	0.12%	0.38%	0.34%	0.11%	0.30%
Nonroad Engines and Vehicles	NA	10.03%	38.27%	16.16%	13.15%	9.50%
Highway Vehicles	NA	43.60%	53.77%	52.88%	44.16%	84.02%
Other Area and Point Sources	NA	46.37%	7.96%	30.96%	42.69%	6.48%
All Sources	NA	100.00%	100.00%	100.00%	100.00%	100.00%

Washington DC MSA Inventory B (in-use est.)
Emission Inventory Summary - Air Toxics and SOx

	tpy					
Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
Lawn & Garden	246	103	435	181	3,045	127
Airport Service	187	13	13	6	8	171
Recreational	22	3	41	18	60	1
Recreational Marine	76	11	47	20	300	13
Light Commercial	42	15	62	26	185	33
Industrial	37	18	16	7	61	36
Construction	1,007	234	57	29	62	1,050
Agricultural	270	73	16	8	24	189
Logging	8	1	4	2	8	2
Marine Vessels	ND	ND	ND	ND	ND	ND
Nonroad Engines and Vehicles	1,895	472	690	297	3,754	1,623
Highway Vehicles	ND	ND	ND	ND	ND	ND
Other Area and Point Sources	ND	ND	ND	ND	ND	ND
All Sources	NA	NA	NA	NA	NA	NA

Washington DC MSA Inventory B (in-use est.)
Emission Inventory Summary - Air Toxics and SOx
Percent of Total Inventory

	% total tpy					
Equipment Category	PM	Aldehydes	Benzene	1,3 But.	Gas. Vap.	SOx
Lawn & Garden	NA	NA	NA	NA	NA	NA
Airport Service	NA	NA	NA	NA	NA	NA
Recreational	NA	NA	NA	NA	NA	NA
Recreational Marine	NA	NA	NA	NA	NA	NA
Light Commercial	NA	NA	NA	NA	NA	NA
Industrial	NA	NA	NA	NA	NA	NA
Construction	NA	NA	NA	NA	NA	NA
Agricultural	NA	NA	NA	NA	NA	NA
Logging	NA	NA	NA	NA	NA	NA
Marine Vessels	NA	NA	NA	NA	NA	NA
Nonroad Engines and Vehicles	NA	NA	NA	NA	NA	NA
Highway Vehicles	NA	NA	NA	NA	NA	NA
Other Area and Point Sources	NA	NA	NA	NA	NA	NA
All Sources	NA	NA	NA	NA	NA	NA

Appendix P. Transport and Nonroad Emissions

"Transport" refers to the phenomenon of windborne ozone and ozone precursors causing elevated concentrations of ozone in adjacent air basins or areas hundreds of miles away from the source of the precursors. Observations of high ozone levels downwind from significant sources of ozone precursors and covering large areas has led to increased interest in the long-range transport of ozone and its precursors. In the context of this study, determining whether emissions can affect ozone levels some distance downwind from the source of the emissions is particularly important in assessing the impact of emissions from nonroad engines operated outside the boundaries of nonattainment areas. For example, one question this study sought to address is "Could categories of nonroad equipment, such as agricultural or marine pleasure craft, operated outside a nonattainment area, have an effect on the level of a pollutant in the nonattainment area?" Questions like this need to be addressed in order to determine and develop the most effective pollution control policy.

Separate studies have concluded that transported pollution is a significant contributor to ozone levels in the Northeast[1] and in California.[2] EPA and several Midwestern States are beginning work on a major study of ozone transport across Lake Michigan; smaller studies of pollution in western Michigan suggest that transported pollutants may be an overwhelming contributor to ozone nonattainment there.[3] Recent studies have found that pollution from Los Angeles may contribute to haze in the Grand Canyon, approximately 250 miles downwind.[4] [5] Elevated levels of ozone also are indicated causing crop damage in relatively remote areas.[6] Even without the completion of all of these studies, Congress acknowledged the role of ozone transport in providing in the CAAA for the creation of regional transport commissions in areas where "interstate transport . . . contributes significantly to a violation of a national ambient air quality standard" (Section 176A(a)). Congress recognized that interstate transport is significant in the northeast by explicitly creating a regional transport commission encompassing 11 northeastern states and the District of Columbia.

In "1. Transport Studies," the major studies to date are summarized and their results discussed. "2. The Effect of Transported Nonroad Emissions" focuses attention on EPA's analysis of these studies in terms of the relationship between transport and nonroad emissions. Finally, "3. Transport Conclusions" focuses on some conclusions regarding transport.

1. Transport Studies

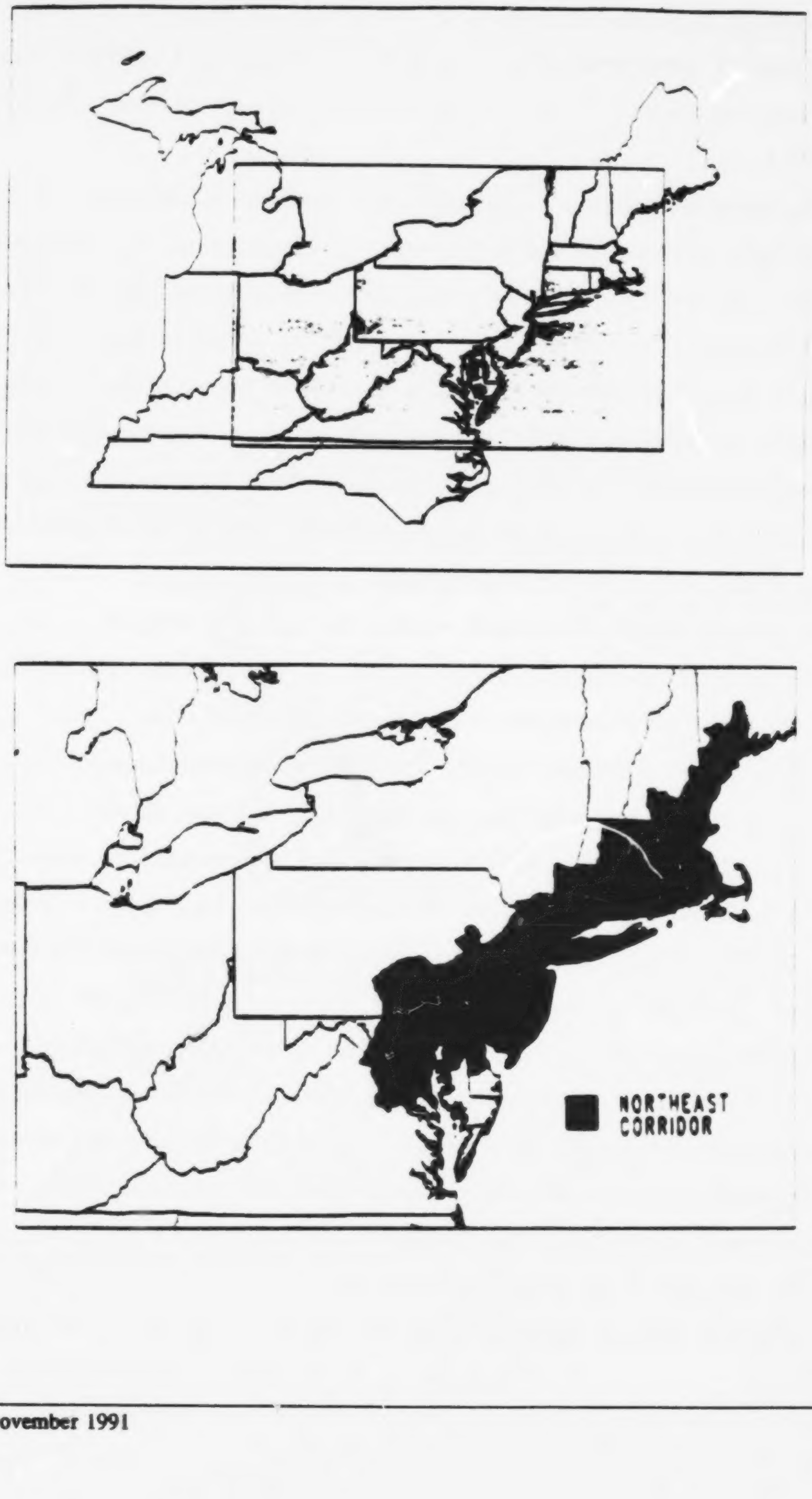
The major transport studies to date include the ROMNET (Regional Oxidant Modeling for Northeast Transport) report, a joint effort among EPA and state and local air officials from the Northeast and Midwest, and "Assessment and Mitigation of the Impacts of Transported Pollutants on Ozone Concentrations within California," a report prepared by the California Air Resources Board as required by the California Clean Air Act. The results of these studies and their implications for the assessment of the impact of nonroad sources on nonattainment are summarized below. This chapter also describes a smaller study addressing the transport of ozone over Lake Michigan and ongoing studies of transport over Lake Michigan and elsewhere.

1.1. Transport in the Northeast

The Regional Oxidant Model for Northeast Transport (ROMNET) project was begun in 1987 as a cooperative effort between state and local air pollution officials and EPA. The primary goals of ROMNET have been to assess the impact of transported ozone and ozone precursors on nonattainment in the Northeast, especially the heavily urbanized Northeast Corridor, and to develop a regional-scale photochemical model that will be used by nonattainment areas to predict the effects of different strategies for attainment. The primary relevance of the ROMNET work to the nonroad issue is its assessment of the overall significance of transport in reducing ozone levels in the Northeast and the role of NO_x in ozone formation in that region.

Maps of the ROMNET region and the Northeast Corridor appear in Chart P-01. The inventories of anthropogenic (manmade) emissions used in the model are based on the 1985 National Acid Precipitation Assessment Program (NAPAP) inventories. The ROMNET model takes into account both anthropogenic and biogenic emissions; the reactivity of different VOC emissions; the impact of seasonal, temporal, and day of the week on emission levels; and the impacts of meteorology and topography on ozone formation and transport. The study includes assessments of several different strategies for reducing ozone levels, including a draft of the Clean Air Act and various combinations of VOC and NO_x reductions.

Chart P-01. The ROMNET Region and the Northeast Corridor.


NORTHEAST
CORRIDOR

To determine the ozone-forming potential of the emission inventory under "real-world" conditions, the model incorporated meteorological data from actual historical ozone episodes. Two recent serious multi-day ozone episodes were chosen for the model based on the presence of "typical" ozone-generating characteristics. Most of the ROMNET results are based on a model of the meteorological conditions during the severe ozone episode of July 4-18, 1988.

In evaluating the impact of various control strategies on reducing ozone in the Northeast Corridor, including the strategy of reducing transported emission, the baseline 1985 emission inventories were projected to the year 2005. The emission from the different source categories were assumed to increase according to predicted growth in highly correlated indicators such as population or employment in the relevant industrial sector. In applying emission control technologies to the source categories, it was generally assumed that the controls could be completely in place and generating 100% of their theoretical effectiveness by 2005, assumptions which are probably quite optimistic. One of the scenarios modeled assessed the impact of relaxing these assumptions.

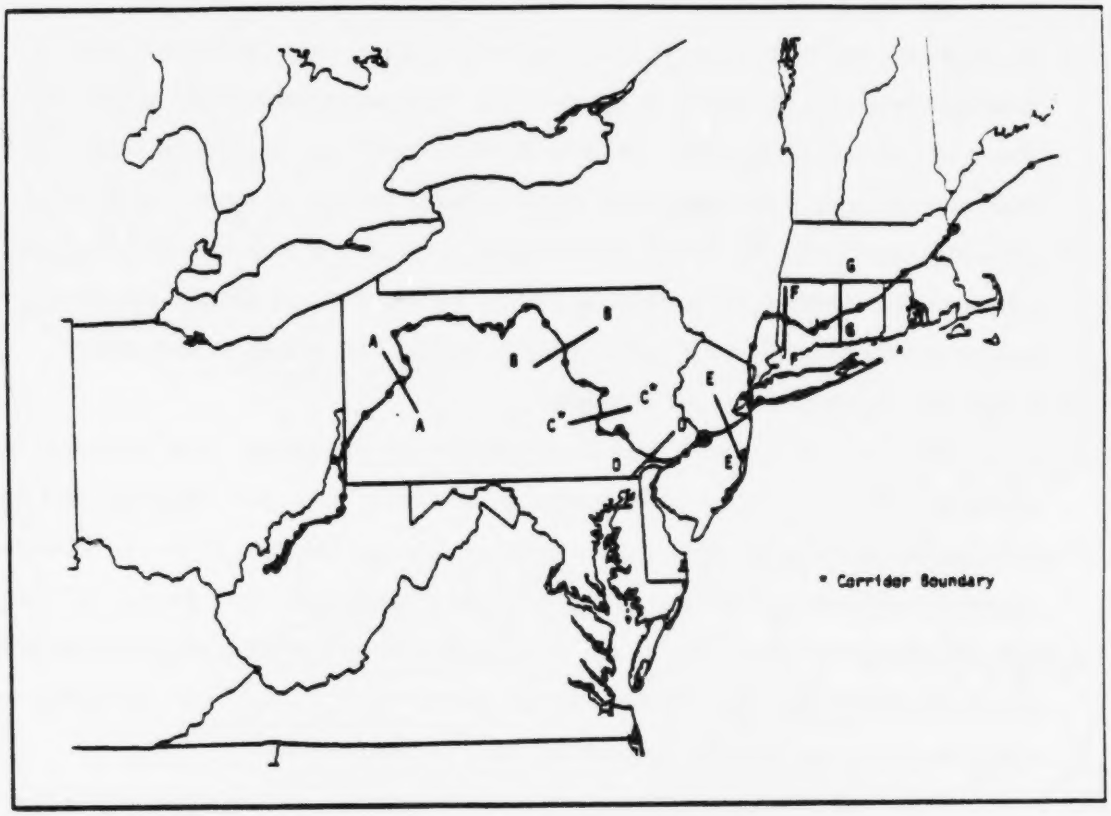
Three control scenarios were used to assess the impact of transport on the nonattainment areas in the Northeast Corridor. One applied maximum control technology for NO_x and VOC to the 2005 inventories over the entire ROMNET area. Another applied the controls only to sources within the Corridor itself. The third scenario applied maximum control technologies only to sources that were outside the Corridor, yet were inside the U.S. portion of the ROMNET region. As an example of how these scenarios compare to the version modeled in the Clean Air Act, the maximum control technology was assumed to reduce, on average, overall VOC emission by 63% and NO_x emission by 57% from the 2005 baseline level. The CAA version would reduce VOC emission by 32% and NO_x emissions by 32% over the same region. In one scenario where controls were applied only outside the Corridor, a packet of air was tracked from an origin in West Virginia up through the Massachusetts coast. Ozone and ozone precursor levels along its route were modeled and compared to baseline (pre-control) levels. This comparison can be used to suggest the distance over which transported pollutants can be expected to have a measurable impact on ozone levels. The path of the air packet and the difference in pollutant levels between the scenarios along that path are shown in Charts P-02 and P-03. As can be seen from these figures, the effect of reducing ozone precursors outside the Northeast Corridor was still noticeable two days after the air packet had passed into the highly polluted Corridor. By the time the air packet reached central Connecticut, it had traveled approximately 340 miles from its point of entry into the Corridor, and yet the reduction in non-Corridor emissions still reduced the predicted ozone level in Connecticut by approximately 5 ppb.

Another assessment of upwind controls on specific nonattainment areas can be made by comparing the ozone levels predicted in the Corridor nonattainment areas under the different scenarios. The effect on these cities of reducing emissions from upwind sources is shown in Tables P-01 and P-02. Table P-01 shows the impact of reducing only non-Corridor emissions on ozone concentrations in Corridor cities. Table P-02 shows the difference in predicted ozone levels for several cities between the scenarios with controls only in the Corridor and controls over the entire ROMNET region. Not surprisingly, the effect is most pronounced for those Corridor cities closest to the Corridor boundary, such as the Washington/Baltimore area and Philadelphia.

The results show that a reduction of 65% of the non-Corridor VOC inventory and 60% of the non-Corridor NO_X inventory resulted in an average peak ozone reduction of 8.6 ppb in the Corridor as a whole and 11.5 ppb average peak ozone reduction in the two western-most nonattainment areas of Washington/Baltimore and Philadelphia. Very roughly, this implies that 1% of the non-Corridor VOC and NO_X inventories account for 0.14 ppb of the peak ozone concentration in the Corridor cities on average and about 0.18 ppb of the peak ozone concentration in the Washington/Baltimore and Philadelphia areas.

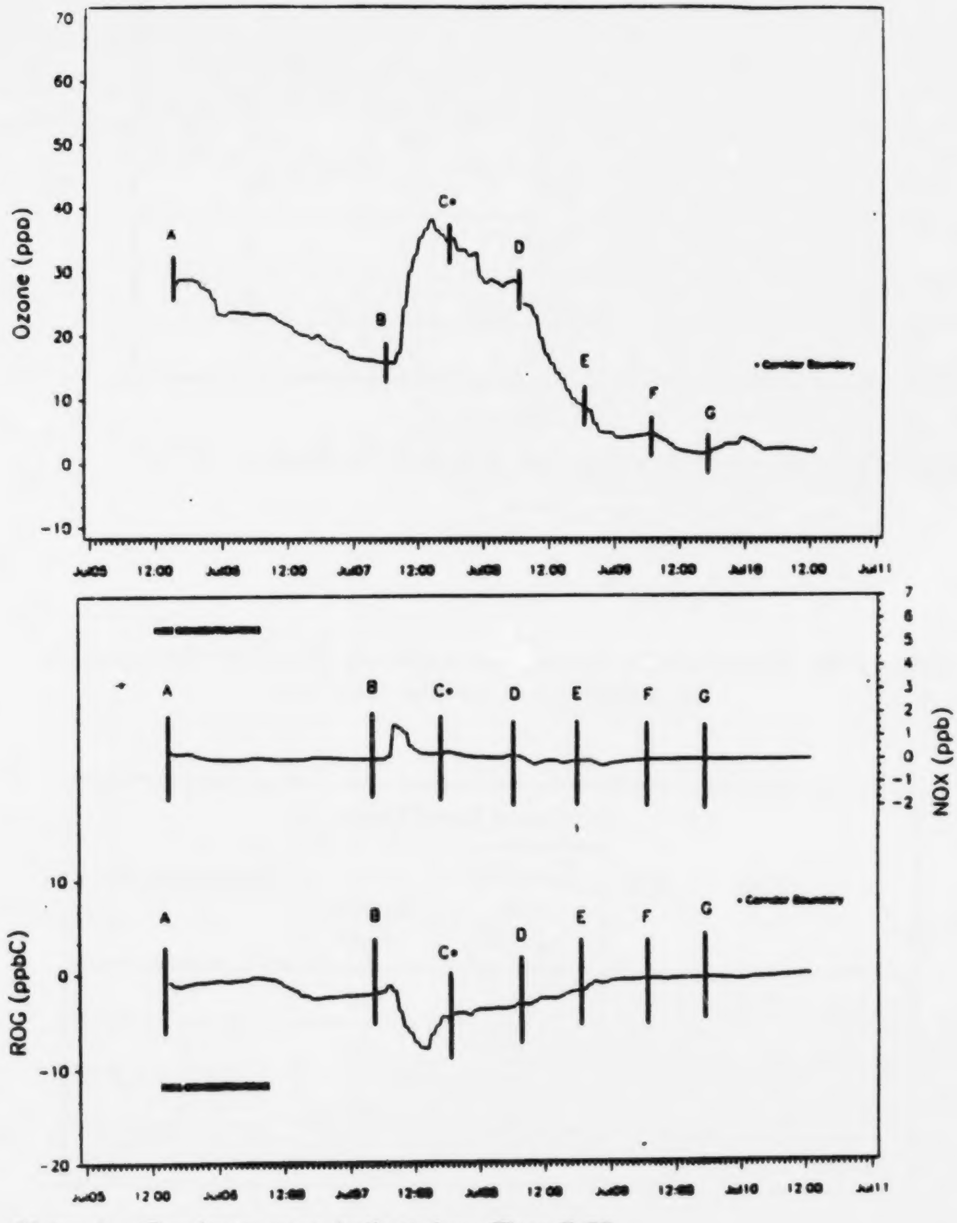
While the reductions in ozone levels due to reduction in transported non-Corridor emissions may not appear large, they should be compared to the reductions predicted for other programs. For example, the ROMNET study also assessed the impact of a control strategy that would convert the entire motor vehicle fleet in the Northeast Corridor to methanol (methanol vehicles have less photochemically reactive emissions) and also reduce the reactivity of solvent emissions throughout the Corridor. Average reductions in ozone levels for the Northeast Corridor cities were approximately 5-8 ppb under this reactivity-based control scenario. These reductions are similar to the reductions predicted for reducing non-Corridor emissions using maximum control technology for VOC and NO_X. Neither measure alone could reduce emissions enough to bring the Corridor into attainment.

Chart P-02. Path of Air Packet from West Virginia to Massachusetts


A
A
B
B
C'
C'
D
D
E
E
F
G
G
* Corridor Boundary

ROM layer 2 trajectory for the transport case study (trajectory markers are at 4-h intervals).

Chart P-03. Differences in Ozone and Precursor Concentrations in Air Packet Along Trajectory from West Virginia to Massachusetts



Note: A - G refer to areas indicated on Chart P-02

Table P-01. Reductions in Corridor Ozone from Uncontrolled 2005 Levels Due to Non-Corridor Controls

City	Ozone Level (ppb)		Reduction (%)
	before control	after	
Baltimore	149	136	9
Philadelphia	148	138	7
New York City	160	152	5
Connecticut	140	133	5
Boston	158	153	3

Note: National Ambient Air Quality Standard (NAAQS) for Ozone = 124 ppb

Table P-02. Reductions in Ozone from Imposing Non-Corridor Controls in Addition to Corridor Controls

City	Ozone Level (ppb)		Reduction (%)
	Corridor-only control	Region-wide	
Baltimore/Washington	139	122	12
Philadelphia	123	115	7
New York City	123	118	4
Boston	113	107	5

Note: National Ambient Air Quality Standard (NAAQS) for Ozone = 124 ppb

According to the ROMNET report, "The results suggest that without stringent upwind controls, ozone levels in parts of the Corridor may not be reduced to below the level specified in the NAAQS even with stringent controls along the entire length of the Corridor." (ES-11) Attainment of the ozone standard across the entire region may require not only maximum control technology across the entire region, but additional substantial across-the-board reductions in VOC emissions in New York City. Again, we should note that the maximum control technologies modeled here were assumed to achieve roughly twice the reduction in VOC and NO_x emissions that are predicted to result from implementation of the minimum requirements of the Clean Air Act. The report goes on to warn: "Considering rule effectiveness and a more realistic representation of control programs, results show predicted episode maximum ozone levels of just above 125 ppb in most sections of the Northeast Corridor with the most stringent VOC/NO_x/reactivity strategy simulated." (ES-11)

1.2. Transport in California

Section 39610(b) of the California Clean Air Act required the CARB to assess the relative contribution of upwind emissions to downwind ozone levels. In June 1990, the Board issued a staff report "Assessment and Mitigation of the Impacts of Transported Pollutants on Ozone Concentrations within California," which assessed the impact of transport for 14 upwind-downwind area pairs.

The California report differs from the ROMNET report in several aspects. For ten of the upwind-downwind area pairs, transport was not assessed using a complete regional air quality model. In these cases, the CARB staff analyzed emission inventories for the upwind and downwind areas, wind patterns that prevailed during nonattainment episodes, the timing of downwind ozone peaks relative to peak precursor-generating periods upwind (e.g., morning and afternoon rush hours), and other available information to determine whether the nonattainment was due primarily to upwind or downwind emissions.

Obviously, this method does not allow for quantitative precision about the impact of upwind emissions on downwind ozone levels. The staff therefore limited its conclusions to categorizing the impact of transport on the downwind area in each transport pair as either overwhelming, significant, or inconsequential. "Overwhelming" impact is defined in the

CARB report as situations in which "ozone exceedances in the downwind area (other than very near the boundary between upwind and downwind areas) occurred without any emission contribution or with only a very small emission contribution from the downwind area." (I.2) "Significant" transport impact was found in cases where "emissions from both the upwind and downwind areas contributed to exceedances of the state standard," (I.2) and "inconsequential" impact was found in areas for which "the staff determined that upwind emissions did not contribute significantly to exceedances of the state ozone standard in the downwind area."(I.2) Some upwind-downwind pairs fell in more than one category; that is, the importance of transport varied substantially depending on meteorology so that transport might be judged substantial under some conditions and inconsequential under others.

The CARB results are shown in Table P-03. For all the transport pairs studied, transport was an "overwhelming" or "significant" contributor under at least some of the meteorological conditions that typically prevailed during ozone exceedances. Transported ozone and ozone precursors have an "overwhelming" impact on nonattainment in five California nonattainment areas under some conditions and a "significant" effect in ten nonattainment areas under some conditions. Some of these areas fall into both the "overwhelming" and "significant" categories due to varying meteorological patterns among ozone exceedance episodes. Most upwind sources of transported pollutants are urban areas, but rural areas also may contribute to downwind nonattainment.

The proportion of VOC and NO_x inventories from nonroad sources in six upwind areas are shown in Tables P-04 - P-09. These tables show what is contributed from each of 5 nonroad categories, as well as the total nonroad contribution and total contribution from all area and point sources. From this, an indication of the proportion of transported pollutants from nonroad sources which impact the downwind area can be drawn.

Table P-03. The Findings of the Impact of Transported Air Pollutants from Upwind Areas on Downwind Ozone Levels

Transport Couple	Overwhelming	Significant	Inconsequential
San Joaquin Valley to Great Basin Valleys*	X		
Broader Sacramento to San Joaquin Valley		X	X
San Joaquin Valley to Broader Sacramento		X	X
Broader Sacramento to Upper Sacramento Valley		X	X
Broader Sacramento to San Francisco Bay Area		X	X
San Franciso Bay Area to Broader Sacramento		X	X
San Franciso Bay Area to North Central Coast	X	X	
San Francisco Bay Area to San Joaquin Valley		X	X
San Joaquin Valley to Southeast Desert*	X		X
South Coast to Southeast Desert	X		X
South Coast to San Diego	X	X	X
South Coast to South Central Coast		X	X
South Central Coast to South Coast		X	X
Coastal Waters to South Central Coast		X	

* Areas currently in attainment of the ozone standard.

Table P-04. South Coast Air Basin Summary

The South Coast Air Basin is an extreme ozone nonattainment area. Under some conditions, emissions from the South Coast overwhelmingly or significantly contribute to ozone levels in the San Diego nonattainment area. Under some conditions, the South Coast contributes significantly to ozone levels in the South Central Coast nonattainment area.

Category	VOC tpd	NO_x tpd
Farm Equipment	0.50	6.14
Nonfarm Equipment	28.55	123.65
Lawn and Garden Equipment	29.20	1.36
Off-Highway Vehicles	0.00	0.00
Marine Vessels	7.33	68.38
Nonroad Mobile Sources(*)	65.58	199.53

All Area and Point Sources	2,138.88	1,174.23

Category	% Total VOC	% Total NO_x
Farm Equipment	0.02	0.52
Nonfarm Equipment	1.33	10.53
Lawn and Garden Equipment	1.37	0.12
Off-Highway Vehicles	0.00	0.00
Marine Vessels	0.34	5.82
Nonroad Mobile sources(*)	3.07	16.99

Notes: (*) excluding railroad locomotives and aircraft.

Table P-05. San Joaquin Valley Air Basin Summary

The San Joaquin Valley is an ozone nonattainment area. Under some conditions, the Valley significantly contributes to ozone levels in the Sacramento nonattainment area. Under some conditions, emissions in the San Francisco Bay Area or Sacramento significantly affect ozone levels in the Valley.

Category	VOC tpd	NO_X tpd
Farm Equipment	8.96	35.80
Nonfarm Equipment	7.06	30.56
Lawn and Garden Equipment	6.00	0.28
Off-Highway Vehicles	0.00	0.00
Marine Vessels	0.22	2.64
Nonroad Mobile Sources(*)	22.24	69.28

All Area and Point Sources	1,194.34	555.98

Category	% Total VOC	% Total NO_X
Farm Equipment	0.75	6.44
Nonfarm Equipment	0.59	5.50
Lawn and Garden Equipment	0.50	0.05
Off-Highway Vehicles	0.00	0.00
Marine Vessel	0.02	0.47
Nonroad Mobile Sources (*)	1.86	12.46

Notes: (*) excluding railroad locomotives and aircraft

Table P-06. San Francisco Bay Area Air Basin Summary

The San Francisco Bay area is an ozone nonattainment area. Under some conditions, emissions from the Bay area overwhelmingly contribute to ozone levels in the North Central coast nonattainment area. Under some conditions, emissions from the Bay area significantly contribute to ozone levels in the Broader Sacramento and San Joaquin Valley nonattainment area. Ozone levels in the Bay are significantly affected by emissions from Sacramento under some conditions.

Category	VOC tpd	NO_x tpd
Farm Equipment	1.26	5.05
Nonfarm Equipment	11.46	48.99
Lawn and Garden Equipment	15.00	0.70
Off-Highway Vehicles	0.00	0.00
Marine Vessels	7.00	81.45
Nonroad Mobile Sources(*)	34.72	136.19

All Area and Point Sources	1,556.12	659.69

Category	% Total VOC	% Total NO_x
Farm Equipment	0.08	0.77
Nonfarm Equipment	0.74	7.43
Lawn and Garden Equipment	0.96	0.11
Off-Highway Vehicles	0.00	0.00
Marine Vessels	0.45	12.35
Nonroad Mobile Sources(*)	2.23	20.64

Notes: (*) excluding railroad locomotives and aircraft

Table P-07. South Central Coast Air Basin Summary

One county (Santa Barbara) of the South Central Coast Air Basin is in nonattainment. The South Central Coast Air Basin is a significant contributor to nonattainment in the South Coast Air Basin under some conditions. The South Coast and the Coastal Waters significantly contribute to nonattainment in the South Central Coast under some conditions

Category	VOC tpd	NO_x tpd
Farm Equipment	2.36	9.43
Nonfarm Equipment	2.53	10.96
Lawn and Garden Equipment	2.80	0.13
Off-Highway Vehicles	0.00	0.00
Marine Vessels	0.00	0.00
Nonroad Mobile Sources(*)	7.69	20.52

All Area and Point Sources	412.29	164.22

Category	% Total VOC	% Total NO_x
Farm Equipment	0.57	5.74
Nonfarm Equipment	0.61	6.67
Lawn and Garden Equipment	0.68	0.08
Off-Highway Vehicles	0.00	0.00
Marine Vessels	0.00	0.00
Nonroad Mobile Sources (*)	1.87	12.50

Notes: (*) excluding railroad locomotives and aircraft.

Table P-08. Sacramento Valley Air Basin Summary

The Sacramento Valley Air Basin is an ozone nonattainment area. Under some conditions, emissions from the Sacramento Valley significantly contribute to ozone levels in the San Joaquin Valley and San Francisco Bay nonattainment areas. Under some conditions, these areas significantly contribute to ozone levels in Sacramento.

Category	VOC tpd	NO_x tpd
Farm Equipment	4.18	16.72
Nonfarm Equipment	6.67	28.89
Lawn and Garden Equipment	4.00	0.18
Off-Highway Vehicles	0.00	0.00
Marine Vessels	0.27	3.41
Nonroad Mobile Sources(*)	15.12	49.20

All Area and Point Sources	364.02	264.30

Category	% Total VOC	% Total NO_x
Farm Equipment	1.15	6.33
Nonfarm Equipment	1.83	10.93
Lawn and Garden Equipment	1.10	0.07
Off-Highway Vehicles	0.00	0.00
Marine Vessels	0.07	1.29
Nonroad Mobile Sources(*)	4.15	18.62

Notes: (*)excluding railroad locomotive and aircraft

Table P-09. San Diego Air Basin Summary

San Diego is an ozone nonattainment area. Under some conditions, emissions from the South Coast Air Basin overwhelmingly or significantly contribute to ozone levels in San Diego.

Category	VOC tpd	NO_x tpd
Farm Equipment	0.15	0.58
Nonfarm Equipment	6.86	29.71
Lawn and Garden Equipment	5.40	0.25
Off-Highway Vehicles	0.00	0.00
Marine Vessels	2.50	41.11
Nonroad Mobile Sources(*)	14.91	71.65

All Area and Point Sources	498.71	245.75

Category	% Total VOC	% Total NO_x
Farm Equipment	0.03	0.24
Nonfarm Equipment	1.38	12.09
Lawn and Garden Equipment	1.08	0.10
Off-Highway Vehicles	0.00	0.00
Marine Vessels	0.50	16.73
Nonroad Mobile Sources(*)	2.99	29.16

Notes: (*)excluding railroad locomotive and aircraft

1.3. Transport in the Lake Michigan Areas

Another area in which transport is believed to have a significant impact on ozone nonattainment is Muskegon, Michigan. Muskegon is a city of 160,000 on the eastern shore of Lake Michigan, approximately 185 km (115 mi) northeast of Chicago. Its persistent nonattainment problems appear to be largely due to emissions from the Chicago area. In July 1988, during a high ozone episode for Muskegon, an instrumented research vessel recorded ozone levels and wind patterns over Lake Michigan to determine if the high ozone levels were being transported over the lake. High ozone levels were observed over the lake and along the shore south of Muskegon. Back trajectories of the air parcels containing the ozone levels showed that these air parcels originated along the heavily industrialized urban southern shore of Lake Michigan. Further evidence of the importance of transport in causing this exceedance is the fact that Grand Rapids, a much larger and more heavily industrialized city than Muskegon approximately 50 km east of Muskegon, approached, but did not exceed, the NAAQS for ozone, although meteorological data were favorable for ozone formation in both Muskegon and Grand Rapids. Back trajectories of the air parcels entering Grand Rapids on this day indicated that they passed over the southern shore of Lake Michigan outside of the urban, industrialized Chicago/Gary area.

EPA's Region V currently is coordinating the development of an Urban Airshed Model that will encompass the greater Lake Michigan area. The Lake Michigan Oxidant Study (LMOS) will assess the transport of ozone precursor emissions and ozone across the lake to better explain the effect of emissions from eastern Wisconsin and the Chicago/Gary area on ozone levels in Michigan. The study will include many new inventories to be developed by EPA and the states bordering Lake Michigan. The Lake Michigan Oxidant Study will be completed in 1993.

2. The Effect of Transported Nonroad Emissions

The fact that ozone is a regional and not a local problem has been demonstrated by studies described previously and is widely understood and accepted. Congress demonstrated their understanding and acceptance of this concept by mandating the creation of regional transport commissions in the CAAA. Transport work now concentrates on assessing the factors impacting transport and developing a way to model and quantify the transport effect.

For the purposes of this study, EPA has used information gathered in developing ROMNET to tentatively quantify the effect of transported nonroad emissions on air quality in the Northeast Corridor. The impact of nonroad non-Corridor emissions may be roughly assessed by looking at the proportion of the non-Corridor inventory generated by the nonroad source categories. These categories are: nonroad diesel, nonroad gasoline, military aviation, civilian (commercial) aviation, general aviation, gasoline vessels, diesel vessels, and residual-fuel vessels. Their proportions of the inventory are shown in Table P-10.

Table P-10. 1985 Nonroad Proportion of Non-Corridor Base Year Inventories (%)

	VOC	NO_x
Nonroad diesel	0.24	3.01
Nonroad gasoline	1.51	0.94
Vessels		
gasoline	0.46	0.04
diesel	0.04	0.35
residual fuel	----	0.03
Total Nonroad	2.26	4.38

Several caveats should be observed in interpreting these numbers. First, the inventory proportions quoted in Table P-03 are for the base year 1985, not 2005, the year for which the control scenarios were modeled. Inventories for 2005 were not available from the ROMNET calculations because of the way in which inventory numbers were aggregated, speciated, and adjusted by the model during its projections. Also, the myriad meteorological and photochemical assumptions built into the ozone level predictions quoted in the last chapter make quantitative generalizations about the effects of changes in transport on ozone levels somewhat hazardous. Nonetheless, these calculations can help to illustrate the relative magnitude of the effect of transported pollutants from nonroad sources on several important nonattainment areas. Taken together, the categories of nonroad engines within the scope of this report accounted for 2.3% of the non-Corridor VOC inventory and 4.4% of the non-Corridor NO_x inventory in 1985. Given the correlation of non-Corridor inventory reductions and Corridor peak ozone reductions posited above,* it appears that transported pollutants from nonroad sources account for roughly 0.5 ppb of the peak ozone concentrations in the Corridor cities as a whole and 0.6 ppb of the peak ozone concentration in the Baltimore/Washington and Philadelphia areas. One context for assessing the importance of these impacts on urban ozone would be to compare the magnitude of the effect of transported nonroad sources to the levels of ozone predicted in the major northeastern cities after the implementation of the Clean Air Act mandates modeled by ROMNET. As shown in Table P-11, transported pollutants from non-Corridor nonroad sources would account for roughly 0.3-0.45% of the ozone level along the East Coast during ozone nonattainment episodes.

Table P-11. Clean Air Act Scenario

	Post-CAA Ozone Level	**% from Noncorridor Nonroad**
Baltimore	134	0.45
Philadelphia	135	0.44
New York City	184	0.27
Boston	131	0.38

---

* One percent of non-Corridor emissions roughly account for 0.14 ppb of the peak ozone concentration in the corridor cities on average, and about 0.18 ppb of the peak ozone concentration of the Washington/Baltimore and Philadelphia areas.

3. Transport Conclusions

An analysis of ROMNET study finds the following:

1. Transport from all sources from non-Corridor areas into the Northeast Corridor contributes to nonattainment in several cities in the Northeast.

2. Currently, nonroad emissions outside the Corridor area account for approximately 2.3% of the VOC non-Corridor inventory and 4.4% of the NO_x non-Corridor inventory (see Table P-10).

3. In the absence of regulation of nonroad sources, the proportions listed in 2 above will probably increase in the future, as regulations are applied to more of the remaining source categories and are further tightened on categories already subject to emission regulation.

4. Nonroad sources cannot be discounted as insignificant merely because they are outside the boundaries of nonattainment areas.

Again, as the studies quoted in this chapter have demonstrated, ozone is a regional and not a local problem. Airborne transport of ozone and its precursors does not stop at city, county, or state boundaries. Apparently, it is not uncommon for transported pollutants to impact ozone levels 200 miles from the source of the emissions. At this time, it is difficult to quantify precisely the distance ozone and ozone precursors typically travel, but clearly a complete list of sources contributing to urban nonattainment cannot stop at the nonattainment area's border. Thus, nonroad sources outside nonattainment areas may be assumed to contribute to urban nonattainment.

EPA and state officials are continuing to study the role of transport in nonattainment. Therefore, our understanding of transport should be considerably expanded within the next few years. EPA's Office of Air Quality Planning and Standards (OAQPS) is currently working on extensions to the results presented in the ROMNET draft study. These include applying the regional oxidant model to the Southeast and Midwest, in addition to modeling the effect of the Clean Air Act, as actually passed, on the Northeast. Much of this work will provide support to states containing nonattainment areas in their efforts to comply with the inventory and air quality modeling requirements of the Clean Air Act. OAQPS will also be working with the Northeast transport commission required by the Clean Air Act to help them develop strategies for attainment. These regional models will continue to use existing national emission inventories, which, as discussed above, have some shortcomings in the area of nonroad emissions. Currently, efforts are underway to establish a new national inventory for nonroad engines and other area and mobile sources, called the Aerometric Information Retrieval System/Area and Mobile Source file (AIRS/AMS). The results of these regional models will be re-evaluated using the new inventories as soon as they are available in 1993.

References

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2. California Air Resources Board. *Assessment and Mitigation of the Impacts of Transported Pollutants on Ozone Concentrations within California.* El Monte, CA: State of California, June 1990.

3. Fitzner, Craig A., et al. "Measurement of Ozone Levels by Ship Along the Eastern Shore of Lake Michigan." *Journal of the Air Pollution Control Association* 39(1989):727.

4. White, W. H., et al., "Observations of Los Angeles Smog in Southern Nevada" presented at the International Specialty Conference on Tropospheric Ozone and the Environment, Air & Waste Management Association, Pittsburgh, PA, March 19-22, 1990.

5. White, W. H., et al., "Regional Transport of the Urban Workweek: Methylchloroform Cycles in the Nevada--Arizona Desert." *Geophysical Research Letters* 17 (July 1990):1081.

6. Aneja, Viney P., et al. "Exceedances of the National Ambient Air Quality Standard for Ozone Occurring at a 'Pristine' Area Site." *Journal of the Air & Waste Management Association*, 40 (1990): 217.

Appendix Q. Response to Public Comment

This appendix summarizes comments EPA received on the October 1991 draft of this report, and the adjustments made to the report in response to comments. A comparison of Charts Q-01 and Q-02 illustrate the effect these changes had on the inventory results for the final report.

Chart Q-01. Median Contributions - Draft Inventory A and B

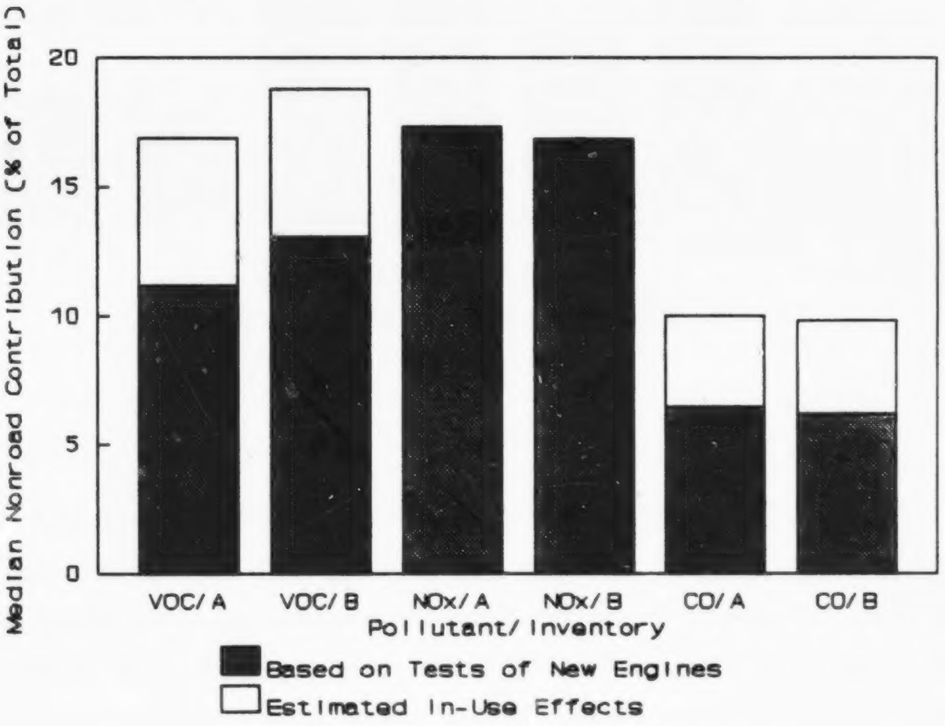
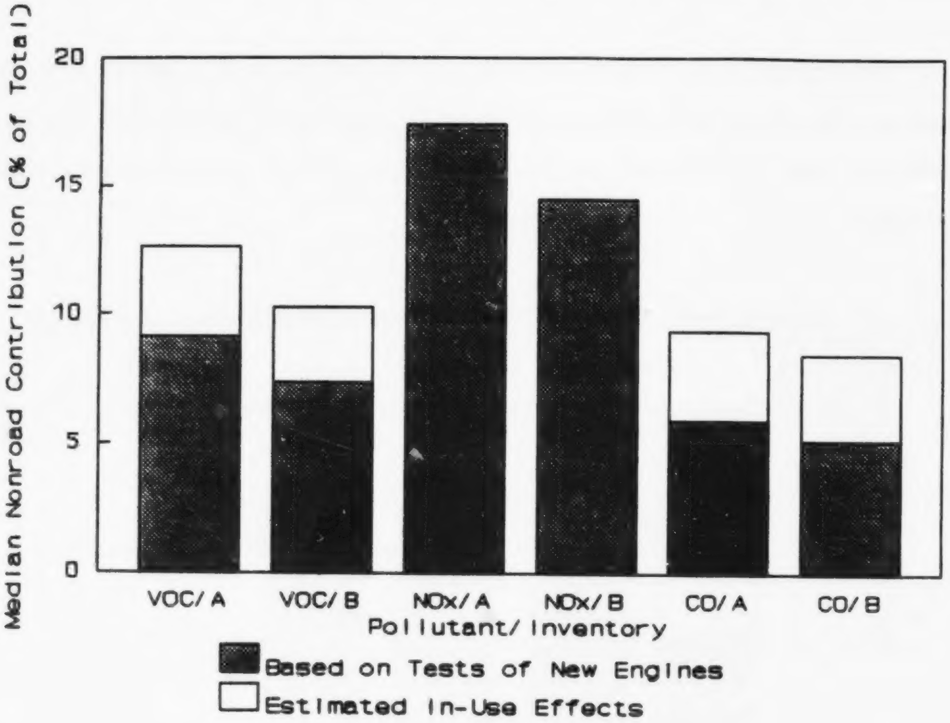


Chart Q-02. Median Contributions - Final Inventory A and B



Comments relating to the development of activity levels, emission factors, and additional considerations are summarized and addressed below. Written comments received from Briggs and Stratton, Engine Manufacturers Association, Equipment Manufacturers Institute, International Snowmobile Industry Association, Industrial Truck Association, OMC, Outboard Power Equipment Institute, National Marine Manufacturers Association, and Payhauler are available in the public docket.

1. Activity Levels

Comments relating to activity levels are discussed by equipment category.

1.1. Recreational Marine Equipment

For the October draft of the nonroad study, EPA relied heavily on data supplied by NMMA from a survey conducted by Irwin Broh and Associates (IB&A) in eight nonattainment areas. The results from this survey were used to adjust local boat registration data to represent actual usage in the nonattainment area (Inventories A and B), determine seasonal adjustment factors (Inventories A and B), and calculate annual hours of use, average horsepower, and load factors for Inventory B.

In comments on the October draft of this report, NMMA requested the following technical revisions be made to activity levels:

1. Use an alternative methodology to determine boat usage based on the concept of "saturation boating".
2. A methodology to extend the saturation boating concept to the 16 unsurveyed areas.
3. Use fuel based activity levels (i.e., gallons/year) and emission factors (i.e., grams/gallon), rather than using horsepower-hour based factors.
4. Use national average fuel usage estimates, based upon the sales of a unique oil formulation used to mix with 2-stroke outboard motor fuel.
5. Correct an error in the calculation of average fuel usage from the survey.

EPA made the following adjustments in response to NMMA's comments:

1. and 2. - Saturation boating methodologies - For Inventory B, a new methodology was developed for the 8 surveyed areas based upon the concept of saturation boating and extended to the 16 unsurveyed areas. Specific equations for allocating boat populations using the concept of saturation boating were developed separately by EPA and NMMA. The equation developed by NMMA was:

$$F = 0.7\ [1 - \exp(-630A)]$$

where:

F = fuel used in the nonattainment area as a fraction of the total fuel used by boats registered in the nonattainment area

A = water surface area available for boating in the nonattainment area divided by the number of registered boats in the nonattainment area.

The equation developed by EPA was slightly different:

$$F = 1 - \exp^{-(238\ A)\ **\ 0.66)}$$

Overall, both formulas yielded similar results (the average ratio for all 24 areas was 39% using NMMA's formula and 39.5% using EPA's). EPA's formula was used in developing Inventory B for the following reasons:

- EPA's formula yielded better r^2 values when regressed against the reported usage ratios from the 8 surveyed areas (.32 vs. .26 for NMMA's formula).
- EPA's formula generated ratios closer to the calculated saturation limits for those areas with high boat densities per nonattainment area water surface area.
- NMMA's formula capped the ratio at a maximum of 70%, which may not be appropriate for areas with very low boat densities per water surface area (although only one of the nonattainment areas studied, Provo-Orem, falls into this category)
- NMMA's actual equation was not submitted until November 7, 1991 (the concept was proposed several weeks earlier).

NMMA specifically requested that this methodology be used for Inventory A, as well as Inventory B. However, EPA was reluctant to totally ignore the survey results from the IB&A survey. Instead, a compromise methodology was used for Inventory A. The IB&A results were used to estimate boat usage in each nonattainment area. This estimate was then compared to the calculated maximum summertime usage based upon saturation boating. In cases where the survey results yielded higher ratios than the calculated saturation ratio, the local estimates were adjusted downward to match the calculated saturation limits. A more complete description of the methodology is contained in Appendix K.

3. Fuel-based activity levels - As recommended by NMMA, both Inventory A and Inventory B were revised from horsepower-hour based calculations to fuel use. Descriptions of how this was done are contained in Appendix I (for emission factors), K (for Inventory A fuel use), and N (for Inventory B fuel use).

4. National average fuel use estimates - The national annual average of 91 gallons per outboard powered boat calculated by NMMA was used for the 16 unsurveyed areas for

Inventory B. The fuel usage for the other recreational marine equipment types was also adjusted for these areas using the outboard ratio of 91 gallons per year to the reported survey results of 142 gallons per year (i.e., 91/142). No adjustments were made to the reported survey results for the eight surveyed areas, or to any areas for Inventory A (fuel usage for Inventory A is based upon information supplied by PSR and BSFC calculations from data supplied by NMMA, not upon IB&A survey results).

5. Error in fuel usage calculations - The error reported by NMMA in calculation of fuel usage from the IB&A survey was corrected and the results recalculated. This primarily affected the calculation of the proportion of boat use in the nonattainment areas for Inventory A (lowering the calculated number of boats used in the nonattainment areas by about 15%).

1.2. Lawn and Garden Equipment

EPA received numerous comments from OPEI and PPEMA. The following comments were all incorporated into Inventory B and, as noted, into Inventory A.

1. Annual hours of use adjustments for commercial use - OPEI commented that the splits between consumer and commercial populations they had supplied for the draft report were erroneously reported as population splits instead of sales splits. The correction roughly halved the commercial populations, with the following impact on the multiplicative adjustments to consumer annual hours of use to reflect the much higher annual usage of commercial equipment:

	Draft	Final
Lawnmower (2-stroke)	x2.5	x2.17
Lawnmower (4-stroke)	x2.5	x1.75
Tiller	x2.2	x1.54

These corrections apply to both Inventory A and Inventory B.

2. Load factors for lawn and garden tractors - OPEI pointed out that load factor adjustments based upon their letter of September 9, 1991 from John F. Linskey to Clare Ryan of EPA had not been incorporated into the draft. This has been corrected in the final report.

dropping the Inventory B load factors from .47 to .38 for lawn and garden tractors, rear engine mowers and front mowers.

3. Horsepower estimates - OPEI commented that errors had been made in their submittal of horsepower ranges for lawn and garden tractors and that 2-stroke snowblowers are smaller than 4-stroke. Based upon new data supplied by OPEI, Inventory B horsepower estimates for lawn and garden tractors dropped from 15.4 to 13.32 and 2-stroke snowblowers from 5.1 to 3.75.

4. Local disaggregation of handheld equipment population - While PPEMA had previously submitted population estimates for hand-held equipment (i.e., chain saws, blowers, trimmers/edgers), for the October draft this equipment was disaggregated to the local level using the general lawn and garden methodology developed for Inventory A. PPEMA subsequently developed a population disaggregation model for hand-held equipment using state-level shipment data and rural, suburban, and urban population splits. PPEMA used this method to directly calculate local equipment populations for chain saws, blowers, and trimmer/edgers. These local population estimates have been incorporated into Inventory B. In addition, as chain saws have very different usage patterns from most lawn and garden equipment (i.e., virtually no individual use by urban residents), the methodology developed by PPEMA was also used to disaggregate local chain saw populations for Inventory A.

EPA received two comments specifically relating to lawn and garden activity levels that have not been incorporated into the final report. First, OPEI commented that the population data for tillers in Inventory A was about 40% higher than in Inventory B, and asked that Inventory A be reduced. Although OPEI certainly knows how many tillers their members sell each year, this is not the same as knowing the population. Engine useful life, annual hours of use, scrappage rates, and consumer/commercial splits all affect equipment populations. PSR uses different methods of estimating populations than OPEI. In most cases, PSR and OPEI generated similar population estimates. There is no available information identifying one population estimate as being clearly superior to the other. Thus, using one method for Inventory A and the other for Inventory B is the most equitable solution.

The second comment that was not incorporated was on tiller load factors. Briggs and Stratton submitted information on the load cycle of several types of equipment. Most of this information either supported the CARB estimates or has been incorporated into Inventory B load factors. The exception was tiller load factors. CARB estimated a load factor of 40% for tillers. The data submitted by Briggs and Stratton was interpreted to yield a load factor of only 20%. However, the dynamometer test used to determine the load on the engine indicated that the engine used .24 gallon/hour to generate only 0.6-0.7 horsepower. This equates to a BSFC of .34-.4 gallons/horsepower-hour, far higher than expected for these engines. A tiller engine using .24 gallons/hour should generate at least twice this amount of power; which would be in line with a 40% load factor.

1.3. Recreational Equipment

ISIA commented that there are no 4-stroke gasoline snowmobile engines in operation in the United States. In response to this comment, the final report assumes that all snowmobiles use 2-stroke gasoline engines for both Inventory A and Inventory B, despite the fact that EPA contractors reported a very small number of 4-stroke engines.

1.4. Industrial Equipment

The hours of use for forklifts used in the draft report for Inventory B were based on a statement by ITA in its comments concerning the workshop held by EPA on April 3-4, 1991, "A typical light-duty forklift truck may be run for 40 hours per week for an average of 2000 hours per year." In its response to the draft report, ITA commented that by "typical" it did not mean average, and stated that 850 hours is the correct average use rate. EPA adjusted the hours of use for forklifts in Inventory B to 850 hours for the final report.

1.5. Agricultural Equipment

EMI submitted data for combines and agricultural tractors which was used in the draft version of this study to construct Inventory B. This data included population figures developed by the U.S. Bureau of Census, which EMI has stated may include seldom-used equipment. EMI has cautioned that, in constructing an emission inventory, appropriate corrections should be made to either the operative population estimate or the estimate of average annual usage. EMI's submitted data contained no such correction. In comment on the draft version of this study, EMI stated that the Inventory B results for agricultural equipment are significantly overstated because EPA did not apply the downward adjustments needed. As EPA does not have any information on how to apply such downward adjustments, EPA has used the same data for Inventory B as used for Inventory A for these two types of equipment in this final report.

1.6. Construction Equipment

Payhauler commented that the draft report contains large distortions in the construction equipment/mining category populations in nonattainment areas, in large part as a result of difficulties arising from the use of product sales and/or industry statistical information in estimating equipment populations. Payhauler listed a number of factors which could increase the possibility of error, including confused product descriptions in the sales record, products are frequently short term rental fleets and moved around the country, and the county of sale is not likely to be the county or even state of use.

No adjustments were made to the final report in response to Payhauler's comments for two reasons. First, EPA does not have any data on which to base such adjustments, nor did Payhauler provide any data. Second, product sales were used in this report only to establish state or national level populations. These populations were disaggregated to the local level using local construction activity indices. Thus, the local population figures should reflect the movement of products around the country to actual jobsites.

2. Emission Factors

EPA received comments from several industry associations, including OPEI, NMMA, EMA, PPEMA, and ITA, regarding the emission factors used in the study. One of the common concerns among the industry associations was related to the development and use of adjustment factors which were applied to new engine emission factors to estimate in-use emission rates. The associations were especially concerned with the limited data that were used to develop the adjustment factors for the equipment categories they represented and suggested that in-use factors should not be applied until more data is collected.

EPA realizes that the in-use adjustment factors are based on limited data and could be improved when additional in-use engine testing is completed. However, the in-use adjustments are EPA's best estimates based on existing data, and are clearly superior to the default of zero in-use deterioration, which would result if no in-use factors were applied. In addition, the inventories in this study are presented two ways, with the in-use adjustment factor applied, and also without the in-use factor applied. This is done by the use of stacked bar charts which readily show the additional contribution of emissions from the in-use adjustment estimates.

The in-use adjustment factors for 2-stroke outboard motors in the draft study report were adjusted downward to 1.2 for HC and CO (from 1.5 for HC and 1.3 for CO) for the final study report. This is discussed in greater detail in Section 2.2.3. of Appendix I. While the arguments presented by NMMA were persuasive as to the superior durability and maintenance of outboard engines, such that these in-use adjustments were made for the final report, they did not support a total lack of in-use engine wear and malmaintenance.

Other comments regarding emission factors were more specific to certain equipment types. OPEI was concerned that the emission factors for snowblowers and commercial turf care equipment should be revised to better represent the horsepower ranges of these equipment. Upon review of the emission factors in the draft study, EPA agreed that these factors warranted adjustment. For snowblowers, the emission factors used for lawn mowers were used for the final study report. For commercial turf care equipment, the emission factors for lawn and garden tractors were used.

OPEI also presented sales data on the proportion of utility engines sold over the last 8 years with open and closed crankcases. Based on this data, the crankcase emission factors for lawn and garden equipment were revised to reflect 22% open crankcases (the draft report assumed 100% open crankcases).

EMA expressed concern that the particulate emission factors used in the draft study report were outdated. The emission factors were derived from AP-42 and based on 1973 tests performed at Southwest Research Institute. EMA suggested that the test results from a recent joint EPA/Industry program to assess test cycles for nonroad equipment be used to revise the particulate emission factors as well as NO_X, HC, and CO emission factors. The particulate emissions from the four 1991 diesel nonroad engines tested suggest that these newer engines have considerably lower particulate emission rates than the emission factors reported in AP-42. To reflect this concern, the particulate emission factors used for Inventory B are the equally weighted average of the AP-42 emission factors and the 1991 EPA/Industry average 8-mode nonroad engine test data. However, because there is no way to determine when diesel engines began to emit lower amounts of particulates, the particulate emission factors for Inventory A remain those reported in AP-42. A more complete discussion of this is contained in Section 1.2.1. of Appendix I.

Another main area of concern for EMA related to the adjustment factor used to convert from steady state emission factors to in-use (transient) emission factors. EMA suggested that the adjustment factor should be corrected to a value halfway between the steady state and on-highway transient values instead of a correction all the way to the on-highway transient, as was done in the draft study report. However, although the transient cycle used to simulate highway heavy-duty engine operation may not be as appropriate to simulate nonroad equipment transient operation, EPA expects that it is a better representation of nonroad equipment that encounters transient operation in use than the 8-mode steady state test (it should also be noted that no adjustments were made for equipment types expected to primarily, but not exclusively, encounter steady state operation). EPA realizes that different equipment types have varying degrees of transient and/or steady state operating characteristics in-use. However, it was beyond the scope of this study to characterize the in-use operating cycles of the numerous equipment types included in the study. Therefore, the final study report continues to reflect the on-highway transient adjustment for those equipment types expected to encounter transient operation in use and no adjustment for those equipment types expected to primarily encounter steady state operation.

3. Additional Considerations/Other Comments

This section summarizes comments received that were not directly related to activity levels or emission factors.

3.1. Use of Equipment Categories

EPA received comments from EMI and NMMA requesting clarification of EPA's use of equipment categories in constructing emission inventories. Both were concerned that the categories used for this study could be construed as potential regulatory categories.

EPA considered over 80 different types of equipment in this report, many of which are highly specialized and have low sales volumes. EPA grouped the equipment types into 10 equipment categories only to assist the disaggregation of national or state equipment populations to the local level, and to ease analysis and reporting of inventory results. EPA has revised the final report to clarify that these categories are not intended to represent potential regulatory categories.

3.2. Inclusion of Two Sets of Inventories

EPA received a request for clarification of the use of two inventories from EMI, and two manufacturer associations expressed concern about data on which Inventory A is based. ITA expressed concern about lack of access to PSR data and methodology and uncertainty about what is included in Inventory A populations. EMI expressed concern about the method used in Inventory A of estimating equipment populations using engine shipment data.

PSR is a commercially available marketing research data base, and the EEA methodology is based on publicly available indices of commercial activity. Although several manufacturers expressed their belief that PSR was not accurately estimating equipment sales, in every case where manufacturers were willing to divulge equipment sales data to PSR or EEA (12 cases total), PSR's estimates showed excellent agreement with the equipment sales data (usually within 5%). In addition, much of the data used in Inventory A was not available from any other source.

EPA also developed a second set of inventories, Inventory B, which relies on manufacturer-provided data for almost all high usage equipment types. This industry-provided data might not be publicly available to states, but does give EPA a valuable cross check for the first set of inventories. In general, EPA regards both inventories as being equally appropriate estimates of nonroad populations and activity rates, and has learned a great deal from the ways in which they differ and agree.

3.3. Transportable Equipment

EMA commented that EPA should include all transportable equipment (e.g., generator sets, compressors, pumps), as well as self propelled, in the nonroad emissions inventory. It is EMA's position that both fall exclusively within the scope of nonroad mobile engines and vehicles, and that both are within the scope of EPA's authority under Title II of the Clean Air Act. EMA states further that EPA can only make a determination to regulate engines used in transportable equipment based on the nonroad study, and that by failing to include all transportable equipment in the study, EPA has failed to meet the mandate imposed on it by Congress.

There were several types of equipment that are not included in this study due to lack of data, not just transportable equipment. For example, mining equipment also is not included in the study. Transportable equipment below 50 hp are included in the study, but transportable equipment over 50 hp are not due to lack of data and potential conflict with stationary source requirements.

EPA does not agree that the exclusion of equipment types from the study either prohibits EPA from regulating such equipment as nonroad engines or violates the mandate imposed by Congress. Congress required EPA to regulate nonroad engines if nonroad emissions are determined to be significant based on this study. However, this is a one-way requirement; it does not forbid EPA from regulating nonroad engines under other circumstances. Further, while Congress mandated that the determination of significance be made for nonroad engines as a whole based on this study, the regulatory requirements are for EPA to ". . . promulgate (and from time to time revise) regulations containing standards applicable to emissions from those classes or categories of new nonroad engines and new nonroad vehicles (other than locomotives or engines used in locomotives) which in the Administrator's judgement cause, or contribute to, such air pollutants." Nothing in this language restricts EPA to only those classes or categories included in this study or prohibits EPA from updating the assessment of emission contributions in the future.

3.4. 2-Stroke Marine VOC Emission Reactivity

NMMA submitted the claim that VOC emissions from 2-stroke marine engines are less photochemically reactive than other forms of VOC emissions. However, NMMA did not submit any data substantiating this claim.

VOC reactivity is a very complicated process. While an important consideration is ozone formation, the reactive processes are far from completely understood. Thus, EPA does not have sufficient information to judge the validity of NMMA's claim. Without data substantiating the overall reactivity of unburned fuel, EPA must use the standard assumption that the VOC reactivity of motor vehicle emissions are relatively similar.

3.5. Conclusions Chapter

NMMA commented that the nonroad study is a technical report and, as conclusions are best left for the regulatory process, suggested that EPA remove Chapter 5 from the report.

The purpose of the conclusion chapter is to highlight major points and to identify the points that EPA considers to be most important. No part in the conclusions is intended to be other than a summary of the data presented in the report. Thus, EPA does not agree that it should be removed.

3.6. Consideration of Updated Information

NMMA requested that EPA make a clear statement in the report recognizing the possibility that improved data may result in changes to the inventories, and that such data, if available and credible, will be used by EPA in the determination of significance and any subsequent regulatory process.

Updated data will not necessarily be used in the determination of significance; nor will it be arbitrarily excluded. However, EPA agrees with the statement that any subsequent regulatory activity will incorporate new information. While EPA does not believe this statement needs to be in the body of the report, it is acknowledged here.

3.7. Transport

In their comments, NMMA and OMC brought up several issues that complicate the estimation of the impact of transported VOC emissions on urban nonattainment. For example, NMMA submitted a report compiled by Sierra Research questioning the impact of VOC emissions on ozone transport. EPA does not necessarily agree with all of these comments, however, the issues raised do illustrate the complex nature of transport, and the difficulty of estimating precisely the impact of relatively distant emission sources on any particular nonattainment area. EPA did not include estimates of the impact of transported emissions on urban nonattainment in the final quantitative inventory estimates in recognition of such difficulties. Reliable quantitative estimates of the impact of transported emissions from marine pleasure craft may become available as existing photochemical models such as the Regional Oxidant Model (ROM) and the Urban Airshed Model (UAM) are further refined and applied to individual nonattainment areas in the next several years. EPA is not attempting to prejudge these results in this report, but merely intends to note that transported ozone or ozone precursors caused by marine pleasure craft used in rural areas and other rural sources may have an impact on urban air quality. The principal conclusions of the impact of all nonroad sources on urban nonattainment contained in this report are based solely on emissions inside the nonattainment areas studied.

In its comments, EMI asserts that transport from more rural areas to urban areas cannot be considered to contribute to urban nonattainment because the concentration of ozone and ozone precursors is generally lower in rural areas. EMI states: The common-sense observation is that if 'Air Mass B' moves into an airshed, then 'Air Mass A', the air already there, has to be moved." To this observation, EPA would add a second observation: that air is not a solid. Elementary principles of physics and meteorology would imply that as Air Mass B enters an area, it mixes with Air Mass A, and that (assuming atmospheric pressure remains constant) some of this mixture exits the area. To the extent that Air Mass B contains air with lower concentrations of ozone and ozone precursors than Air Mass A, this mixing will lower the concentration of ozone in the urban area. However, the effectiveness of this mixing in lowering the concentration of ozone in the urban area is dependent on the concentration of ozone and ozone precursors in the entering Air Mass B, and not merely on the fact that this concentration may be lower than the concentration in the preexisting Air Mass A.

To illustrate this principle, let us assume first that Air Mass B contains no ozone or ozone precursors. Clearly, then, the concentration of ozone and ozone precursors in the mixture of Air Mass A and Air Mass B would be much lower than the concentration in Air Mass A before it was diluted. On the other hand, we could consider a case where Air Mass B has concentrations of ozone and ozone precursors that are only slightly lower than those concentrations in Air Mass A. Under this scenario, the concentrations of ozone and ozone precursors in the mixture would be nearly the same as those concentrations in the urban Air Mass A. Thus, emissions of ozone precursors into a rural air mass can have a deleterious impact on urban air quality by reducing the ability of prevailing winds from rural areas to dilute the pollution in urban air.

These conclusions were borne out by the EPA study entitled "Regional Oxidant Modeling for Northeast Transport", or "ROMNET". This study was based on a detailed photochemical air quality model (the Regional Oxidant Model or ROM) for the northeastern quadrant of the U.S. EMI has urged elsewhere in their comments that EPA apply this ROM model to the study of emissions from nonroad sources specifically. ROMNET traced the formation of ozone levels in the major northeastern urban areas during specific ozone episodes by incorporating detailed information on emissions and meteorological conditions prevailing during those episodes. The ROMNET study incorporated emissions from nonroad sources along with all other sources of ozone precursors. The study was specifically designed to determine if transport from the western, generally rural part of the ROMNET region (e.g., Ohio, western Pennsylvania) had a negative impact on air quality in the major coastal urban areas (e.g., Philadelphia) during conditions that were known to have produced an actual exceedance of the ozone standard. The study concluded that this transport did, in fact, contribute to nonattainment of the ozone standard in the coastal areas, despite the fact that actual levels of ozone and ozone precursors in an air "packet" as it passed over the more western areas were considerably lower than the levels of ozone and ozone precursors in that air "packet" as it passed through the coastal urban areas.

Elsewhere in the Clean Air Act, Congress apparently concurred with the conclusion that emissions in rural areas can contribute to urban nonattainment. In Section 184 of the Clean Air Act, Congress explicitly created an Ozone Transport Commission comprising 11 northeastern states and the District of Columbia. Congress had concluded that the transport of ozone and ozone precursors in this region was so significant that the air pollution control policies of these states should be coordinated to insure their fairness and effectiveness. Included by law in the Ozone Transport Commission is the State of Vermont, a rural state with no ozone nonattainment areas.

3.8. Determination of Significance/Air Quality Analysis

EMI suggested that the October draft does not provide sufficient information for a determination of significance. EMI believes that:

> "In order to meet the requirements of Section 213(a)(2) the CAA with respect to a determination of significance, an air quality analysis which takes into account heterogeneity in the geographical distribution of nonroad engines/ vehicles, seasonal factors, transport and other atmospheric variables, and which includes photochemical modeling, is required."

As EMI discusses at some length in their comments, EPA does not base the contribution of nonroad engines to ambient air quality problems on photochemical air quality modelling in this study. EPA reiterates its previous position that photochemical modelling is not required to draw valid scientific conclusions about the contribution of nonroad emissions to nonattainment, and that Congress did not intend to require EPA to construct such models.

In the nonroad study, EPA has assumed that the contribution of nonroad sources to the concentration of ozone during a nonattainment episode is proportional to the contribution of nonroad sources to the total amount of VOCs and NO_X emitted in that area by all sources. This is the approach that has historically been taken by EPA in determining the contributions of different sources to nonattainment and in estimating the general effectiveness of nationwide air pollution control measures. It is based on the widely accepted scientific position that urban ozone is formed by the reaction of VOCs and NO_X in the presence of sunlight. Congress in no way indicated that it intended for EPA to digress from this approach; in fact, the legislative history of the CAA clearly shows that Congress conceived of the relative significance of nonroad sources in terms of their contribution to the total inventory of VOCs and NO_X. The Senate Committee Report notes that "[e]missions inventories from EPA estimate that farm and construction equipment emit 3.7 percent of CO nationwide, 4 percent of nationwide NO_X, and 1.3 percent of total hydrocarbons." The Senate Report further states "While inventories of these emissions are not precise, estimates indicate the extent to which they contribute to ozone and other pollution problems." (Senate Report No. 101-228, p. 104) Clearly, the intended mandate of Section 213 is that EPA improve upon existing emissions inventories for nonroad sources and that a conclusion about the significance of nonroad sources could be based on these inventories.

Further, in placing a one-year deadline for the completion of the nonroad study, and an additional one-year deadline for issuing standards based on the results of the study, Congress indicated a certain urgency in addressing this long-neglected category of pollution sources. The one-year deadline is one of only a very few specific requirements for performing the nonroad study; in general, EPA was not told how to perform the study, but rather to complete it quickly. This deadline effectively precludes the time-consuming development of photochemical models. The Regional Oxidant Model for Northeast Transport (ROMNET) study, which covers only the Northeast quadrant of the U.S., took over five years to complete. An Urban Airshed Model of the Lake Michigan area is also expected to take several years to produce results. Due to the time and expense required to develop photochemical models, Congress has required only states with serious, severe, and extreme nonattainment areas to include them in their State Implementation Plans for attainment of the ozone standard. These areas were given 4 years to complete State Implementation Plans; areas that were not required to include photochemical models were required by Congress to submit State Implementation Plans in 3 years (CAA Section 182).

Finally, it is quite possible that Urban Airshed or Regional Oxidant Modelling would not offer any significant increase in our understanding of the significance of nonroad sources to the nationwide urban nonattainment problem. These models were developed primarily to help individual nonattainment areas determine the effectiveness of specific air pollution control measures, given highly detailed data and assumptions for the unique conditions prevailing in that area. Thus, the models could be used to assess whether a given proposal for reducing emissions from a type of nonroad source would be more effective in a given area than some other measure. However, emission control measures have not yet been proposed for any nonroad source and Congress mandated that the nonroad emission study assess the impact of *current* inventories before EPA issued any such proposals.